SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NRL Report 8755	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* AUTOMATED ACCEPTANCE TEST PROCEDURES FOR WIDEBAND MICROWAVE SYNTHESIZED SIGNAL GENERATOR TESTING		5. TYPE OF REPORT & PERIOD COVERED Final report on a continuing NRL problem 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR*(s)* J. J. O'Neill and T. H. Gattis		8. CONTRACT OR GRANT NUMBER*(s)*
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Research Laboratory Washington, DC 20375		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS NRL Prob 75-0125 Proj Elem OMN
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Electronic Systems Command Code 81514 Arlington, VA		12. REPORT DATE September 30, 1983 13. NUMBER OF PAGES 89
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT *(of this Report)* Approved for public release; distribution unlimited		
17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)* Automatic testing IEEE-488 instrumentation bus Spectrum analysis Microwave signal generator Frequency domain		
20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)* Standardized acceptance test procedures have been developed to enable the Navy to check precisely the performance characteristics of its new synthesized microwave signal generators which operate over a frequency range of 0.1 to 26.5 GHz (gigahertz). Extensive use of IEEE-488 bus-controlled instrumentation and a central processor/computer allows most of the measurements to be done automatically. Details of the individual tests performed and the hardware and software used to implement the tests are given. Test time has been reduced by at least a factor of five (conservative estimate), and test accuracy and repeatability have been enhanced significantly.		

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NRL Report 8755

Automated Acceptance Test Procedures for Wideband Microwave Synthesized Signal Generator Testing

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Information Technology Division

September 30, 1983

NAVAL RESEARCH LABORATORY
Washington, D.C.

CONTENTS

AUTOMATED ACCEPTANCE TEST PROCEDURES FOR WIDEBAND MICROWAVE SYNTHESIZED SIGNAL GENERATOR TESTING

INTRODUCTION

The Naval Research Laboratory (NRL) has been tasked by the Naval Electronic Systems Command (NAVELEX) to develop automated acceptance test procedures to be used to evaluate the performance characteristics of the Navy's new wideband microwave synthesized signal generators. The test system developed makes maximum use of IEEE-488 bus controlled instrumentation and a central processor/controller which allows most measurements to be accomplished under processor control. Use of the Hewlett-Packard Model 8566A Spectrum Analyzer and other new equipment under bus control has virtually eliminated the need for subjective judgments by the test operator. The time required for completion of the tests has been greatly reduced. Test results are more accurately and precisely documented. Test procedures are standardized and precisely defined.

Details of the individual tests performed and the hardware and software used to implement the tests are included in the appendices. These procedures represent refinements and improvements developed after intensive use for 6 to 9 months.

Two sample units from each Systron-Donner Corporation or Giga-tronics, Inc., production lot of 10 are selected at random in accordance with the testing requirements [1,2]. They are shipped to the Navy testing facility where they undergo rigorous production tests to verify that the equipment meets applicable specifications. If both samples pass all tests, the entire lot of 10 is accepted by the Navy and delivered to the Fleet. Should either sample fail to meet the specifications, the entire lot may be rejected. When the problem is remedied, another random sample of two units is selected and the testing restarted. The cost of all retested lot samples is charged to the manufacturer.

PERFORMANCE ACCEPTANCE TESTS

A listing of the acceptance tests for the production-lot sample follows.

- Status: Frequency lock and amplitude level; performed at normal, minimum, and maximum operating temperatures.

- Level accuracy: Power output level (dBm) vs frequency (GHz); normal, minimum, and maximum operating temperatures.

- Maximum output: Maximum unleveled power (dBm) vs frequency (GHz); normal minimum, and maximum operating temperatures.

- Level calibration: Verification of attenuators to -90 dBm.

Manuscript approved July 1, 1983.

- Spur hunt: Search (0.01 to 23 GHz) for harmonic and non-harmonic outputs caused by 20 randomly selected output frequencies.
- Phase noise: At 10 kHz, offset for 20 randomly selected frequencies.
- On/off ratio: Pulse/square wave carrier ON:OFF ratio; 10 frequencies.
- Sweep output: Output level and ramp output check in sweep mode.
- Center frequency pulling: Due to pulse modulation.
- Power meter accuracy: Internal PM vs external reference PM.
- Internal pulse width: Internal calibration, maximum, minimum pulse widths.
- External pulse modulation: Verify operation; external pulse generator.
- External reference lock: Verify operation with external reference.
- Remote control: Check operation with IEEE-488 bus controller.
- Residual FM: Residual FM on unmodulated CW output.
- Frequency counter: Verify frequency counter function operation.
- Cable calibration: Verify cable calibration function operation.

The last two items apply only to the Giga-tronics Model 1026. These features were added by the manufacturer and not required by the specification; however, since they are available, both must be functioning properly for the sample lot to pass.

The details of these sample production-lot tests are the subject of the remainder of this report.

TEST EQUIPMENT REQUIRED

The test equipment required is listed below. If the suggested model can be replaced by an equivalent instrument, */eq* will follow the model number. However, *if* the suggested model is *not* used, the software listed in the appendices may have to be modified to accommodate the equipment used.

Equipment	Suggested Model	IEEE-488
Spectrum analyzer	HP-8566A	Y
Power meter	HP-436A /eq	Y
Power sensor (+10 to -30 dBm) Coaxial 10 MHz to 26.5 GHz	HP-8485A /eq	N
Computer/controller	HP-26/36 /eq	Y
Crystal detector (Coax .01 - 26.5 GHz)	HP-8473C /eq	N
A/D converter or DVM	HP-59313A /eq	Y

Equipment	Suggested Model	IEEE-488
Pulse/function generator	HP-8111A /eq	N
Crystal reference (5 MHz)	HP-5062C /eq	N
Microwave frequency counter, coaxial input DC to 26.5 GHz	SD-6054B /eq	Y
Modulation analyzer	HP-8901A /eq	Y
Microwave synthesizer	HP-8340A /eq	Y
Mixer (coax/10 GHz)	MITEQ MCO-1A /eq	N

DESCRIPTION OF PRODUCTION TESTS

Status: Frequency Lock and Amplitude Level

In this test, the frequency of the unit under test (UUT) is varied in 10 MHz steps over the entire operating frequency range (FR) of 100 MHz to 26.5 GHz, while the output amplitude is maintained at its maximum leveled value of +5 dBm. At each of the 2640 frequency steps, the UUT is commanded by the test controller to send back its status message for interrogation. Contained in this binary message is an indication that the UUTs output frequency is phase locked to its reference frequency and that the output amplitude leveling loop is within its operating range and able to maintain the proper output power level to within ±1 dB. A false indication for either or both of these status messages triggers the controller to print the fault condition and the frequency at which it occurred on a hardcopy test record.

This test is performed at room temperature on both test samples after they have been unpacked and turned on for at least 1 hour. It is also performed every 4 hours during both the maximum and minimum operational temperature tests.

Appendix A shows a typical printout from this test, the block diagram of the test set-up, and a listing of the program on the HP-85 controller, written in Basic. At the start of the test run, the first line printed is the test frequency range as: RANGE | 0.1 → 26.5 | Steps 2640. This means that 2640 frequency steps are taken from 0.1 to 26.5 GHz. Any frequencies at which there is an UNLOCK or UNLEVEL status message are printed next. The end of the test run is signaled by "STATUS TEST" followed by the model and serial numbers of the UUT, the date and time of test completion, and the temperature and relative humidity.

Output Level Accuracy: Power Out (dBm) vs Frequency (GHz)

This test monitors the UUT's output power level with a Hewlett-Packard (HP) 436A power meter and 8485A sensor, which is capable of making coaxial power measurements from 10 MHz to 26.5 GHz. The UUT's frequency is stepped by any desired increment greater than 1 MHz (usually 100 MHz is chosen) over the full FR, and the power meter sends the output power level to the controller. The controller adds to this raw power reading any correction factors necessary to compensate for the calibrated roll-off (vs frequency) of the particular power sensor used. If any coaxial cables are used between the UTT's output and power sensor's input, their correction factors are also added at this time. The final corrected output power level vs. frequency is then plotted and becomes a permanent record of the UUT's output power accuracy.

This test is usually performed at power levels of +5 dBm and -4 dBm, giving two plots on the same set of axes. Like the status test, this test is performed at room temperature after initial warm-up and immediately following both the maximum and minimum operating temperature runs. If any discrepancies are detected, the parameters of the test may be easily varied to make a detailed study of the problem area.

Appendix B/C shows a typical plot generated by this test, the test set-up block diagram, and a listing of the program on the HP-26/36 controller(s) written in HPL language. The data plot gives the model and serial numbers of the UUT, the ambient temperature during the test, and the date and time that the test was completed. The straight horizontal lines on either side of the plotted data are ±1 dB about the set level of the UUT. Vertical lines are drawn at 18 GHz and 26 GHz to mark the region where the level accuracy specification changes to ±2 dB.

Maximum Output: Maximum Unleveled Power (dBm) vs Frequency (GHz)

The program and test configuration for this test are similar to those used in the output level test. The only difference is that the output level called for by the controller is greater than the unit is capable of producing. This causes the UUT to output the maximum power it has available in an unleveled mode. The plot in Appendix B/C shows this unleveled fluctuation very clearly on a set of axes similar to those used for the level accuracy plot. The important criterion for this plot is that the lowest value of the unleveled output power must be greater than +5 dBm for the leveling loop to operate correctly at +5 dBm.

Level Calibration: Verification of Output Attentuator

This test involves checking the 10 dB/step attenuator of the UUT over its entire operating range of 0 to -90 dB. Since the number of possible measurements which could be made is extremely large, five frequencies (0.1, 2, 9, 18, and 22 GHz) across the FR of the UUT were selected. If a problem is detected or suspected, more frequencies in the suspect region may be examined. If any errors in attenuator calibration are found, they are confirmed by making a completely independent measurement with the Weinschel VM-4A.

The programmable spectrum analyzer was chosen for this test over the Weinschel VM-4A for several reasons: simpler test configuration, less time required to make connections, frequency range is covered by single test set-up (VM-4A limited to 18 GHz without external down conversion), and the analyzer allows an operator to view actual level of signal being measured (confidence in measurement is increased). A discussion of the WM-4A program and operation is the subject of a soon-to-be released report [3].

Since the attenuator on the SD-1626 is not programmable, while that on the GT-1026 is programmable, two separate versions of this program had to be written. Only the Giga-tronics version is given in Appendix D. The Systron-Donner version differs in that each time the attenuator is stepped the program must pause, tell the operator to make the step change, and then continue with the measurement. The output data from this test can be configured in two ways: all measurements can be printed in tabular form, or only errors greater than a specified limit can be printed; this saves paper and operator time in examining the data. Appendix D shows this latter type of data presentation. The program is arbitrarily set to print out whenever an error greater than ±1.5 dB is detected between the Nom Level and Meas Level columns. The test printout includes the date, model and serial numbers of the UUT, and the magnitude to any detected errors shown in the Diff (difference) column. The completion of the test is signaled by a two-line printout. The first line gives the condition for error printing, and the second line lists the frequencies which were checked. The program listing given in Appendix D is, again, for the HP-26/36 controller(s) using HPL language and mandates the use of a HP-8566A Spectrum Analyzer.

Spur Hunt: Harmonic/Nonharmonic Spurious Response Search

This test programs the UUT to output approximately 20 randomly selected, unmodulated frequencies. At each frequency, the 8566A Spectrum Analyzer examines successive 1 GHz-wide portions of the frequency spectrum for any discrete responses greater than the specification limit of -55 dBc. If any responses are found, the analyzer determines their frequency and level and prints them out on the hardcopy test record. After the test is complete, any printouts which exceed the specification are examined in a manual mode of operation to verify that they are true responses at the levels indicated. This test consumes approximately 20 minutes of actual running time and is a good example of the power of the automated testing procedure.

The printout for this test in Appendix E shows a line which indicates that the UUT was set to a specific test frequency (1026 Set Freq = X.XXX GHz), followed by all the detected responses (frequency and level) for that set frequency on indented lines. If no spurious responses were detected, only the fundamental output responses (indicated by its high level) should be printed. At generator frequencies above 23 GHz, the fundamental is not detected because the search is only from 0 to 23 GHz. To obtain the true level of any spurious response relative to the fundamental (dBc), a correction for the cable loss at the spurious frequency must be added to the values given in the Level (dBm) column of the data sheet. This program, written for the HP-26/36 controller(s), uses HPL language and necessitates the use of the HP-8566A Spectrum Analyzer.

Phase Noise: 10 kHz Offset in 1 Hz Bandwidth

This test programs the UUT to output approximately 20 randomly selected, unmodulated frequencies. At each frequency, the 8566A Spectrum Analyzer tunes itself to center the selected frequency, opens its span to 10 kHz/div, and measures the noise level one division away from the carrier frequency. The firmware in the 8566A then converts the measurement from the measurement bandwidth to an equivalent 1 Hz bandwidth. The data printout from this test gives the frequency of the test, the measured carrier level (dBm), the 10 kHz offset level converted to a 1 Hz bandwidth in dBm/Hz, and the phase noise at the 10 kHz offset in dBc/Hz.

This program is written for the HP-26/36 controller, using HPL language, and requires the use of the HP-8566A spectrum analyzer. This test requires approximately 3 minutes to complete. The test setup is identical to that used in the spur hunt test and is given again in Appendix F for consistency.

On/Off Ratio: Pulse or Square Wave Carrier On to Off Ratio

This test programs the UUT to output approximately 20 randomly selected frequencies, to which internal square wave modulation is applied. The 8566A is tuned to each frequency, and its span is set to zero Hz to recover the modulated square wave. The delta marker function of the analyzer is then used to measure the peak-to-peak value of this recovered modulation in dB, which just happens to be the desired on/off ratio. Each reading and its frequency is recorded on the hard-copy printout. After the final ratio is measured, the average on/off ratio for all the measurements is computed and printed.

Typical data from this test, the measurement test set-up, and a listing of the test program written for the HP-26/36 controller(s) in HPL language is shown in Appendix G. The program listing is the Systron-Donner version. Separate versions are necessary due to the software operation of the square-wave modulation function.

Sweep Output: Sweep Mode Level Output Check; Ramp Output Check

This test calls for the swept output of the UUT to be measured via a crystal detector connected directly to the RF output. The output of this detector is sampled by an A/D converter which takes readings every 10 ms. At the completion of the sweep, the A/D detector is set to monitor the sweep ramp output voltage as the frequency again is swept through the same range as before. The detector output is plotted on the Y-axis vs the ramp voltage on the X-axis. The output of the detector is then calibrated in dBm by reconnecting the A/D cable to the crystal detector and by plotting the measured response for various dB settings of the UUT's output as its CW frequency is stepped (20 steps) across the range of the sweep.

Some typical plots from this test, the test set-up, and a program listing for the HP 26/36 controller(s) in HPL language are given in Appendix H. On the plot, the left vertical axis is proportional to the output voltage of the crystal detector. The right vertical markings give the translation of these relative A/D numbers to power levels in dBm. The horizontal frequency axis is a constructed digital scale based on the analog sweep ramp voltage and the sweep start and stop limits. The discrete spikes which occur are due to band changes, another oscillator being switched in to provide the output over that portion of the sweep range.

Center Frequency Pulling: During Pulse Modulation

This test measures the amount that the center frequency of the UUT is displaced due to the incidental FM created during pulse modulation of the UUTs CW output frequency. The modulation applied to the CW signal is 10 microseconds (μs) wide at a pulse repetition frequency (PRF) of 5 kHz. The program, wirtten in HPL for the HP-26/36 controller, requires the use of the HP-8566A Spectrum Analyzer. The UUTs output frequency may be varied over all or any portion of the 0 to 23 GHz range of the analyzer. For this test the pulse-modulated CW frequency is stepped in 100 MHz steps from 100 MHz to 23 GHz. At each frequency step, the analyzer tunes to the set frequency and recovers the modulation envelope pattern of the pulse modulated signal. Using the delta frequency marker function of the 8566A, the frequency shift (+ or -) is measured between the set frequency at the center of the display and the peak of the detected envelope. From this difference, the frequency offset of the center frequency of the modulated signal from the true center frequency of the CW output is computed. If this offset is greater than 1 part in 10^{-6} ($1pp10^6$), the printer outputs the set frequency; the frequency error, delF, in Hz; and the frequency offset, delF/F, in parts. At the conclusion of the test, the maximum positive and negative offsets are printed with the number of frequencies which exceeded $1pp10^6$.

A typical data sheet giving the date of the test, the model and serial numbers, the program listing in HPL language, and the test setup is shown in Appendix I.

Power Meter Accuracy: Internal PM vs External Reference PM

In this test, power measurements are made with the internal crystal power meter (PM) of the UUT for comparison to identical measurements made with a calibrated HP-436A PM. The differences at each frequency and level are then computed for comparison with the specification. Provision is made within the program for two separate 8485A sensors and their appropriate correction factors which will be used to make the reference measurement.

Appendix J gives the diagram for the test setup, a program listing in HPL for the HP-26/36 controller(s), and a sample data printout from a typical test. The program is flexible; it allows any start, stop, and step size to be chosen for this test. The Giga-tronics 1026 test generally is run from 2 GHz to 26 GHz, in 2 GHz steps, at three or four power output levels from 0 to -25 dBm, since

the power reading from the UUT can be made automatically via the IEEE-488 bus. The step size for this test is usually selected to be 4 GHz since the PM readings from the Systron-Donner 1626 must be typed in manually as they are read from the UUT's front panel. For this reason and because of the cable/sensor switching involved, two separate versions of this test have been written, neither of which is totally automatic from start to finish. The data sheet first lists the output level setting of the UUT for the test. This is followed by six columns of data: the frequency in GHz, the UUT PM reading in dB, the reference PM readings from the HP-436A, and the difference of the UUT reading minus the reference readings. For output levels greater than -20 dBm, the differences should be less than ±1 dB below 18 GHz and ±2 dB above 18 GHz. For outputs from -20 dBm to -30 dBm, the specification is ±2 dB and ±3 dB respectively.

Internal Pulse Width: Calibration, Maximum, Minimum Pulse Widths Measured

In this test, the internal pulse modulator operation is checked by setting its pulse width to the calibrated 1 μs position, the variable minimum pulse width position, and the variable maximum pulse width position at a PRF of 5 kHz and about ten different RF output frequencies across the FR of the UUT. For each pulse width at each frequency, the 8566A is tuned to place the RF output frequency at the center of the display. The span appropriate to the pulse width is then chosen, so that the first two or three lobes of the modulated (sin x)/x pattern are displaed on the analyzer's CRT. The test operator is told to move the marker to the first null above the main lobe. With this marker positioned correctly, the operator continues the program, which reads the marker separation in kHz and computes the pulse width in μs as the reciprocal of this separation. This procedure is followed for each of the three pulse widths at every frequency. After the maximum width is measured, the controller displays the results of these calculations in the table format shown in Appendix K.

Since neither the variable pulse width nor PRF controls are programmable, this test is only semiautomatic. This means that the program operation must be halted while the test operator performs a nonprogrammable function and then restarted after the action is completed. Two separate versions of this program are required due to the differing nature of the bus controls on the units from two separate manufacturers. The test configuration and Systron-Donner version of this program, which is written in HPL for the HP-26/36 controller(s) and requires approximately 10 minutes to complete, are given in the sample data printout in Appendix K.

External Pulse Modulation: Visual Verification

This semiautomatic test uses three pulse widths and four PRFs from an external pulse generator to modulate five different RF frequencies from the UUT through its external modulation input jack. Initially, the modulation is applied to a 3 GHz carrier, and the 8566A is adjusted to display the familiar (sin x)/x pattern. Then the RF frequency is changed while the test operator observes the spectrum analyzer display and verifies that the same general pattern is present at the other RF frequencies. Each time a change in the modulating signal is required, the operator is instructed by the controller, and the new condition is manually set on the pulse generator. This allows any available pulse generator to perform this test. The printout for this test is simply the test name and date along with the model and serial numbers of the UUT. Any notes on anomalies in the observed patterns can be typed in by the test operator following these data.

Two separate versions of this test were required also due to the differing nature of the bus controls. The test verification printout, the test setup, and a listing of the program for the Giga-tronics generator written in HPL for the HP-26/36 controller(s) are given in Appendix L.

External Reference Lock: Operation from an External Standard

This test checks the UUT's ability to synchronize its output frequency with an externally applied reference signal. Since the UUTs from the two different manufacturers require different reference frequency inputs (10 MHz for the Giga-tronics, 1 MHz for the Systron-Donner), the test configuration shown in Appendix M can generate either of these references from a standard 5 MHz crystal source. Due to this difference, this test is also written in two separate versons. The program initially displays the test setup on the controller's CRT and waits for the test operator to make the necessary connections. After the correct reference is generated by the HP-8111A function generator, it is plugged into the UUT's reference input. The UUT is then programmed for approximately 20 CW output frequencies across its entire frequency range. At each frequency, the output frequency is checked on the counter, which is driven by the same reference. The status message from the UUT is read by the controller to ensure that the generator is locked to the external reference and levelled. If the frequency error is greater than 1 kHz, the printout will state this in kHz, together with the magnitude of the error.

The program listing given in Appendix M is for the Systron-Donner unit and is written in HPL for the HP-26/36 controller(s). The frequency counter used in this test, for which the software in the program listing is written, is the Systron-Donner Model 6054B.

Remote Control Operation: IEEE-488 Bus Operation

There is no specific test which checks the remote operation via the IEEE-488 bus. This function is checked by the proper operation of the UUT during all the other tests listed in this report.

Residual FM: Residual Frequency Modulation on CW Carrier

This test uses the HP-8901A Modulation Analyzer to measure the residual FM present on the UUTs CW carrier in a 50 Hz to 15 kHz bandwidth. For residual FM, the AVERAGE detector measurement is made, and this result is multiplied by $\sqrt{2}$ and $2\sqrt{2}$ to obtain the peak and peak-to-peak readings shown in the data. The residual FM specification is less than 1 kHz peak-to-peak (p-p) in a 50 Hz to 15 kHz bandwidth at output frequencies below 1 GHz. Above 1 GHz, the specification is 0.0001% of the CW carrier frequency. Due to the input frequency limitation of the 8901A, which is 1.3 GHz, two separate versions/configurations of this test are used. These are both given in Appendix N. For frequencies above 1.2 GHz, the second test setup is used. This employs a mixer and another synthesizer as a local oscillator to translate the output of the UUT down to the measurement range of the 8901A. In most cases, the beat frequency chosen in this set-up was 1.0 GHz. The residual FM of the local oscillator must be substantially below that of the UUT to be measured; an HP-8672A or HP-8340A work well in this application. If no high quality local oscillator is available, two of the UUTs may be used with the assumption of equal contribution to the measured residual FM. In this case, the final results should be divided by the $\sqrt{2}$ to obtain the residual FM for a single unit. For this special case, the peak-to-peak residual FM of a single UUT is equal to twice the measured AVERAGE FM reading of the 8901A.

The program for residual FM, written for the HP-26/36 controller(s) in HPL language, is given in Appendix N along with a typical printout of the test data.

Frequency Counter Operation: Checks Counter (Giga-tronics only)

This test is not covered by the equipment specification since the frequency counter function is an added feature of the Giga-tronics 1026. However, since it is available and will be used when the units are deployed in the Fleet, verification of its proper operation is necessary. The simplest manner in which this check may be made is to use two Giga-tronics units, one as the UUT and the other as the frequency source to be counted. The Program written in Appendix P was developed for this. This requirement is necessary because a single Giga-tronics unit cannot count directly its own frequency. The program sets the frequency source to approximately 10 random CW frequencies. It then sets up a search window on the counter UUT which encompasses the particular source frequency. The UUT counter is then put into its measure mode. When it locks onto the input frequency, the front panel of the UUT displays the measured frequency. It is then available to be read by the controller, which prints the set frequency, measured frequency, and the difference on the test record. If the counter does not lock or acquire the input frequency after trying various search window sizes and sample rates, the test output will print that the counter could not find the particular frequency and proceed to the next test frequency.

The counter check program, written for the HP-26/36 controller(s) in HPL language, is given in Appendix O, along with a printout of a sample test data sheet and the diagram of the test configuration.

Cable Calibration Check: Functional Operation (Giga-tronics only)

This test is not covered by the equipment specification because the cable calibration is an added feature of the Giga-tronics 1026. Since it is available and will be used when the units are deployed in the Fleet, verification of its proper operation is necessary. The program written for this test tells the operator exactly what to do on the UUT to perform the cable calibration measurement. After this is completed, the cable is removed from the internal power meter of the UUT and attached to the power sensor of he HP-436A power meter. At this time, a level accuracy test (see Output Level Accuracy test above) is run on the UUT as if the sensor were connected directly to the RF output connector. If the UUT is performing as it should, the power loss in the cable will be compensated for automatically by the UUT, and the plot of the output level will look similar to those shown in Appendix B/C. The only precaution here is that the levelled power asked for at the end of the cable must not require an output power from the UUT greater than it has available. This would result in an unleveled condition in the leveling loop.

A sample plot from this test, a listing of the program, and a diagram of the test configuration are given in Appendix P. The program is written in HPL language for the HP-26/36 controller(s) and requires approximately 10 minutes to complete.

SUMMARY AND CONCLUSIONS

This report summarizes the detailed operation of the sample lot test procedures used as the accept/reject criteria for the Navy's new synthesized microwave signal generators manufactured by Systron-Donner, Inc. and Giga-tronics, Inc. For those desiring to use these procedures, the appendices give a detailed program listing as well as the test equipment configuration for each test.

These procedures have been used with great success at the Naval Research Laboratory to conduct sample testing of production lots since September 1982. They will continue to be employed in this same capacity and will be expanded as required.

These test procedures represent a new level of quality in the ability of the Navy to test and evaluate the performance characteristics of its synthesized microwave signal generator assets. In several areas they exceed the manufacturers' capabilities to measure the performance parameters of their equipment.

The use of the Hewlett-Packard Model 8566A Spectrum Analyzer and the virtual elimination of the need for subjective judgments on the part of the test operator have reduced test time requirements significantly (5:1 conservative estimate). At the same time, the very highest degree of accuracy is maintained.

These test procedures clearly demonstrate the advantages of performing complex testing using a central processor/computer connected via an IEEE-488 interface bus to the test instrumentation. The most important advantages are:

(1) Test results are precisely and accurately documented.

(2) Test procedures are well defined and standardized.

(3) Test time is significantly reduced.

(4) All data reduction calculations are done precisely and accurately according to data reduction algorithms.

(5) The training and experience required for a test operator is significantly reduced.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the support of Mr. L. Shoemaker of the Naval Electronic Systems Command and the engineering staffs at Giga-tronics, Inc., and Systron-Donner, Inc., for their attentiveness and technical discussions.

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3. J. J. O'Neill and T. H. Gattis, "Attenuation Measurement of Wideband Signal Generators," unpublished report.

Appendix A

STATUS TEST

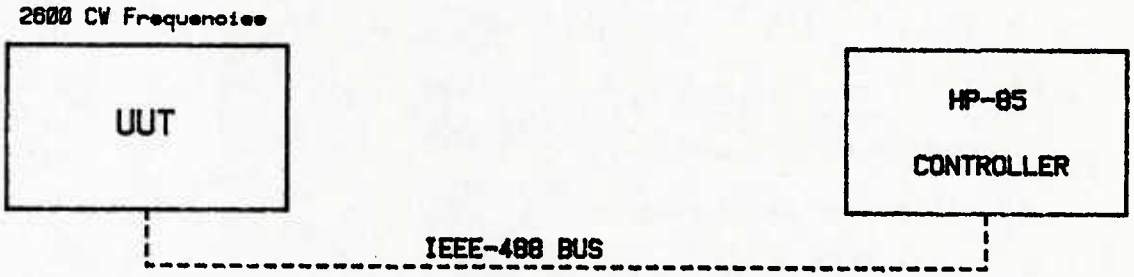


Fig. A1 — Status test — Frequency LOCK/Amplitude LEVEL

STATUS TEST

Language: BASIC Controller: HP-85

```
10 ! Unattended STATUS TEST on 1 or 2 units  IT(1-2)I
20 ! Run one UUT (725) into freq uency counter
25 ! On second UUT (724) read only status message
30 ! Use SD-6054B Counter
35 ! Revision 4: JJO 10/7/82
40 ON ERROR GOSUB 1140
50 LINPUT "INITIALIZE? Y/N",Q$
60 IF UPC$(Q$[1,1])="Y" THEN LIST 6000,6500 @ PAUSE
65 I=1 @ GOSUB 6000
80 LINPUT "Set TIME?  hr:min:sec [EL]=NO ",C$
85 IF LEN(C$)>3 THEN SETTIME HMS(C$),1
90 CLEAR @ F0=0 @ N=0 @ I=0
100 WAIT 100
110 A(1)=725 @ A(2)=724
140 A=0
190 DISP "UUT? G=G/T1026 S=S/D1626 O=OTHER";
200 INPUT U$@ U$=UPC$(U$[1,1])
210 GCLEAR @ CLEAR
220 KEY LABEL
230 CLEAR
240 DISP "Connect Equipment"
250 DISP "(CONT) when ready"
260 PAUSE
270 F1=.1
280 DISP "START Freq (GHz)  [EOL]=.1";
290 INPUT F1
300 F2=26.5
310 DISP "STOP Freq (GHz)  [EOL]=26.5";
320 INPUT F2
330 F3=2640
340 DISP "STEPS [EOL]=2640";
350 INPUT F3
360 CLEAR
361 E=0
362 DISP "[EL]=StartNOW / Enter StartHOUR";
363 INPUT E
364 IF E#0 THEN GOSUB 5000
365 IMAGE 7A,DDD.D,3A,DDD.D,7A,DDDDD
370 PRINT USING 365 ; "RANGE I",F1," -}",F2;"I Steps",F3
380 E=0
390 IF Z<3 THEN I=1 @ GOTO 500
400 IF Z>2 THEN I=I+1 @ GOSUB 6000
500 FOR J=F0 TO F3
510 F=F1+(F2-F1)*J/F3
560 IF U$="G" THEN GOSUB 1200
570 IF U$="S" THEN GOSUB 1300
580 IF U$="O" THEN GOSUB 1400
583 IF J#F0 THEN 590
585 IF INT(Z/2)#Z/2 AND I=1 THEN PRINT " E/M  F(GHz) F(GHz)
 F/F"
590 IF INT(Z/2)#Z/2 AND I=1 THEN GOSUB 1100
```

```
600 IF U$="G" THEN GOSUB 3000
610 IF U$="S" THEN GOSUB 3100
620 IMAGE DDD.DDD,X,DDD.DDD,X,SDDD.DDD
630 IF INT(Z/2)#Z/2 AND I=1 THEN DISP USING 620 ; F,Q,(Q-F)*1
000000
632 IMAGE DDD.DDD,7A,DDD,DDD
634 IF INT(Z/2)=Z/2 AND U$="G" THEN DISP USING 632 ; F," STAT
US",B,C @ GOTO 638
635 IF INT(Z/2)=Z/2 AND U$="S" THEN DISP USING 632 ; F," STAT
US",B @ GOTO 638
636 IF Z+I=5 AND U$="G" THEN DISP USING 632 ; F," STATUS",B,C
637 IF Z+I=5 AND U$="S" THEN DISP USING 632 ; F," STATUS",B
638 WAIT 200
640 NEXT J
650 PRINT
660 GOSUB 2000
665 IF I=1 AND Z>2 THEN 370
670 GOTO 5000
680 PAUSE
1000 ! **** SUBROUTINES **** !
1100 ! --- FREQ MEASURE --- !
1102 IF F<2 THEN OUTPUT A4 ;"HEN"
1103 IF F>=2 AND F<10 THEN OUTPUT A4 ;"HDN"
1104 IF F>=10 THEN OUTPUT A4 ;"HCN"
1105 ENTER A4 ; Q
1117 IF F<2 THEN OUTPUT A4 ;"N"
1118 IF F<2 THEN ENTER A4 ; Q
1120 IMAGE "Err  ",DD.DDD,X,SD.DDe,X,SD.DDe
1122 IMAGE "MEAS ",DD.DDD,X,SD.DDe,X,SD.DDe
1125 Q=Q/1000000000
1130 IF ABS((F-Q)/F)>.00001 THEN PRINT USING 1120 ; F,Q-F,(Q-
F)/F
1135 IF INT(F/5)=F/5 OR F=1 THEN PRINT USING 1122 ; F,Q-F,(Q-
F)/F
1140 RETURN
1200 ! --G/T 1026 FREQ SET-- !
1205 IF J=0 THEN OUTPUT A(I) ;"GENFIXED MODOFF LEVEL 5"
1210 IMAGE 2A,5D
1215 OUTPUT A(I) USING 1210 ; "FA",1000*F
1220 WAIT 200
1225 RETURN
1300 ! --S/D 1626 FREQ SET-- !
1305 IF J=0 THEN OUTPUT A(I) ;"H001L0M0N0G0F0E0D0"
1310 IMAGE A,5Z
1315 OUTPUT A(I) USING 1310 ; "H",1000*F
1320 WAIT 200
1325 RETURN
1400 ! --- OTHER FREQ SET --- !
1405 IF J=0 THEN OUTPUT A(I) ;"K0503" @ OUTPUT 728 ;"A13B24"
1410 IMAGE A,9Z,2A
1415 OUTPUT A(I) USING 1410 ; "P",F*10000000,"Z9"
1420 WAIT 200
1425 RETURN
```

```
1500 ! --- BLOCK DIAGRAM --- !
1510 GCLEAR
1520 SCALE 0,10,0,10
1530 MOVE 0,5 @ GOSUB 1640
1540 MOVE 7,5 @ GOSUB 1640
1550 MOVE 1,5.9 @ LABEL "UUT"
1560 MOVE 7.5,5.9 @ LABEL "COUNTER"
1570 MOVE 3,6 @ IDRAW 2,0
1580 MOVE 7,6.5 @ IDRAW -1.5,0
1590 MOVE 7,5.5 @ IDRAW -1.5,0
1600 MOVE 5.25,5 @ IDRAW 0,2
1610 MOVE 2,9.2 @ LABEL "CONFIDENCE TEST"
1620 PAUSE
1630 CLEAR @ RETURN
1640 IDRAW 3,0 @ IDRAW 0,2 @ IDRAW -3,0 @ IDRAW 0,-2 @ RETURN
2000 ! --- LABEL TEST --- !
2010 IF U$="G" THEN S$=S2$
2020 IF U$="S" THEN S$=S2$
2025 IF U$="O" THEN S$=S2$
2030 IF U$="G" THEN S1$="G/T 1026"
2040 IF U$="S" THEN S1$="S/D 1626"
2045 IF U$="O" THEN S1$="HP-8672A-E24"
2050 IMAGE 13A, 8X,11A
2055 IF I=1 AND INT(Z/2)#Z/2 THEN PRINT "      CONFIDENCE TES
T"
2056 IF I=2 AND Z=3 THEN PRINT "       STATUS TEST"
2057 IF INT(Z/2)=Z/2 THEN PRINT "       STATUS TEST"
2060 PRINT USING 2050 ; S1$,S$
2070 PRINT USING "10A,12X,9A" ; MDY$(MDY(D$)+DATE-1),TIME$
2080 PRINT USING "4A,2A,3A,12X,5A,3A,A" ; "T = ",T$," 'C","RH
 = ",H$,"%"
2085 PRINT "" @ PRINT "" @ PRINT ""
2090 RETURN
3000 ! +++++ STATUS +++++
3002 ! -- Giga-tronics --
3004 OUTPUT A(I) ;"SENDSTATUS"
3006 ENTER A(I) ; Z$
3008 B=VAL(Z$[7,8])
3010 C=VAL(Z$[15,16])
3012 IMAGE 10A,DDDDD.DDD
3014 IF B=0 THEN PRINT USING 3012 ; "UNlock at",F
3016 IF C=0 THEN PRINT USING 3012 ; "UNlevel at",F
3018 RETURN
3100 ! -- Systron-Donner --
3102 ENTER A(I) ; B
3104 IMAGE 10A,DDDD.DDD
3106 IF B=1 OR B=3 THEN PRINT USING 3104 ; "UNlock at",F
3108 IF B=2 OR B=3 THEN PRINT USING 3104 ; "UNlevel at",F
3110 RETURN
```

```
3200 ! -- HP-8672A --
3202 ENTER A(I) ; B
3204 B=VAL(DTB$(B))
3206 B=INT(B/100)
3208 C=B/10
3210 B=INT(B/10)
3212 IF F>2 AND FP(C)#0 THEN PRINT USING "10A,X,DDD.DDD" ; "U
Nlevel at",F
3214 IF FP(B/10)#0 THEN PRINT USING "10A,X,DDD.DDD" ; "UNlock
 at",F
3216 RETURN
4000 OUTPUT A4 ;"B2R1" @ RETURN
4100 OUTPUT A4 ;"B3R1" @ RETURN
5000 ! -- TEST TIMING --
5010 ALPHA 0,0 @ CLEAR @ I=0
5020 ALPHA 6,10
5030 DISP " TIME OF DAY"
5040 DISP ""
5050 DISP "            ";TIME$
5055 DISP "" @ DISP ""
5056 DISP "       Test in Progress"
5057 DISP ""
5058 DISP "         DO NOT DISTURB  "
5060 A$=TIME$
5070 T=VAL(A$[1,2])
5075 IF E#0 AND T=E THEN 370
5080 IF E=0 AND INT(T/4)=T/4 THEN 370
5090 WAIT 1000
5100 GOTO 5000
6000 ! --- Initialize ---
6010 D$="10/13/1982" ! DATE
6020 IF I=2 THEN S2$="s/n 25007-2"
6030 IF I=1 THEN S2$="s/n 23004-1"
6040 A(1)=725
6050 A(2)=724
6060 A4=720
6070 T$="25" ! TEMPERATURE
6080 H$="60" ! HUMIDITY
6090 Z=4 ! Test TYPE: 1=(1)conf      2=(1)stat 3=(1)conf/(1)s
tat     4=(2)stat!
6500 RETURN
```

```
RANGE :    .1 -> 26.0: Steps 2590

        STATUS TEST
S/D 1626                    s/n 23009-2
12/01/1982                   16:30:18
T = 40 'C                   RH = 50 %


RANGE :    .1 -> 26.0: Steps 2590

        STATUS TEST
S/D 1626                    s/n 25005-2
12/01/1982                   17:00:37
T = 40 'C                   RH = 50 %


RANGE :    .1 -> 26.0: Steps 2590

        STATUS TEST
S/D 1626                    s/n 23009-2
12/01/1982                   20:30:16
T = 40  C                   RH = 50 %


RANGE :    .1 -> 26.0: Steps 2590

        STATUS TEST
S/D 1626                    s/n 25005-2
12/01/1982                   21:00:36
T = 40 'C                   RH = 50 %


RANGE :    .1 -> 26.0: Steps 2590

        STATUS TEST
S/D 1626                    s/n 23009-2
12/02/1982                   00:30:17
T = 40 'C                   RH = 50 %


RANGE :    .1 -> 26.0: Steps 2590
```

Fig. A2 — Sample data sheet — (Sheet 1 of 2)

```
RANGE :    .1 -> 26.0: Steps 2590
UNlevel at     .100
UNlevel at     .300
UNlevel at     .310
UNlevel at     .320
UNlevel at     .330
UNlevel at     .340
UNlevel at     .350
UNlevel at     .360
UNlevel at     .370
UNlevel at     .380
UNlevel at     .390
UNlevel at     .400
UNlevel at     .410
UNlevel at     .420
UNlevel at     .430
UNlevel at     .440
UNlevel at     .450
UNlevel at     .470
UNlevel at     .480
UNlevel at   11.790
UNlevel at   11.800
UNlevel at   11.810
UNlevel at   17.560
UNlevel at   17.570
UNlevel at   17.580
UNlevel at   17.590
UNlevel at   17.910
UNlevel at   17.920
UNlevel at   17.930
UNlevel at   17.940
UNlevel at   17.950
UNlevel at   17.960
UNlevel at   17.970

        STATUS TEST
S/D 1626                    s/n 26004-2
03/11/1983                   09:01:02
T = 40.0 'C                 RH = 50 %
```

Fig. A2 — Sample data sheet — (Sheet 2 of 2)

Appendix B/C

OUTPUT LEVEL ACCURACY TEST

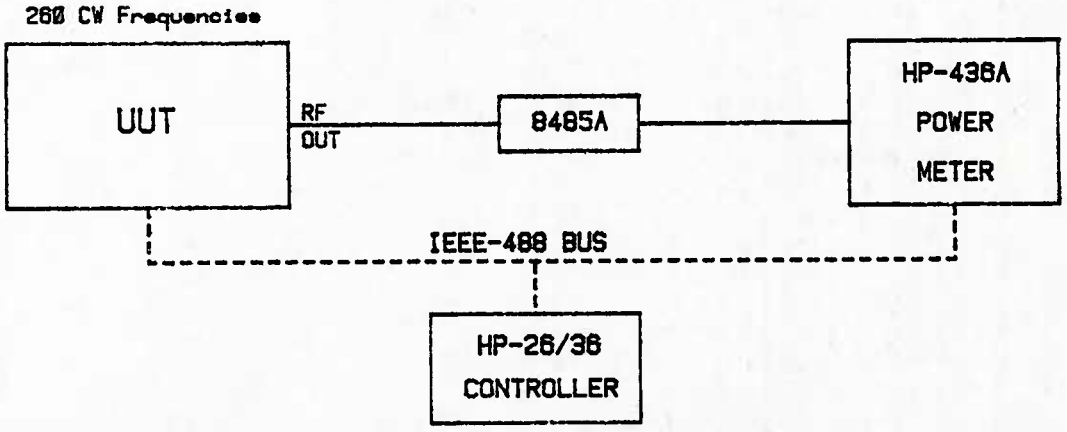


Fig. B/C1 — Level accuracy/maximum power test

LEVEL ACCURACY / MAX POWER TEST

Language: HPL Controller: HP-26/36

```
0: "POWER SWEEP MEASUREMENT with CAL-F CORRECTION - (PS1)":
1: "Author: JJO 1/81; revised  4/15/83";
2: "For S/D1626 : G/T1026 : HP8673A; PM Direct or Coax; 436A
(watts)":
3: "ONE measurement/data point; tone with data":
4:
5: for J=0 to 9;sfk J;next J
6: getk "PSkeys"
7: gclr;aclr
8:
9: dim X$[80],S$[25],V[3],A$[8,2],C$[10],Y[30],N$[15]
10: dim T$[8],D$[10]
11: gsb "INIT"
12: dsp "Press k9 'INIT' for change / [C]=NOchange";stp
13: ent "SET Clock?  [C]=No 1=Yes",Q;if flg13;0}Q
14: if Q=1;cll 'CLOCK'
15: ent "Test Unit? [C]=G/T1026 1=S/D1626 2=HP8673A",G;if flg
13;0}G
16: ent "[C]=Leveled   1=Max Output",L;if flg13;0}L
17: ent "8485 S/N? [C]=648 1=163 2=180",S;if flg13;0}S;gsb "6
48"
18: if S=1;gsb "163"
19: if S=2;gsb "180"
20: ent "START Freq? (GHz)  [C]=0",V[1];if flg13;0}V[1]
21: ent "STOP Freq? (GHz)  [C]=26.5",V[2];if flg13;26.5}V[2]
22: ent "# Freq STEPS?  [C]=265",V[3];if flg13;265}V[3]
23: if L=0;ent "Output LEVEL? (dBm) [C]=5",W;if flg13;5}W
24: dim F[0:V[3]],A[0:V[3]]
25: if I=0;gsb "CRT"
26:
27: "->":for I=0 to V[3]
28: if I=0;gto 50
29: 0}T
30: "FREQ EQUATION":V[1]+(V[2]-V[1])*I/V[3]}F
31: if F<1;pbeep 100,.05
32: if F>=1;pbeep F*100,.05
33: if G=0;gsb "G/T"
34: if G=1;gsb "S/D"
35: if G=2;gsb "HP"
36: 1e9*F}F[I]
37:
38: gsb "436A"
39: cll 'CF'(F,Y)
40: if D#5;gsb "COAX LOSS"
41:
42: T/3+.047(100-Y)+Z}A[I]
43: plt F,A[I]
44: "STATUS":if G=0 and L=0;gsb "Stat-GT"
45: if G=1 and L=0;gsb "Stat-SD"
46: if G=2;gsb "Stat-HP"
47: fmt 7,f5.2," dBm ",f8.3,f5.0,2f3.0;if G=0;wrt .7,A,F,I,U,
V
```

```
48: if G=1 or G=2;wrt .7,A,F,I,U
49: if I>0;fmt 6,f8.3,f7.2,f9.2,f7.2;wrt 16.6,F,A[I],A[I]-A[I
-1],.047(100-Y)
50: next I;pbeep 800,2
51: gto "PLOT"
52:
53: "436A":for J=1 to 1
54: wrt 713,"A+V";fmt ;red 713,A;red 713,A
55: if A<0;1e-6}A
56: 10log(A/1e-3)}A;A+T}T;3T}T
57: next J;ret
58:
59: "PLOT":psc 16;gclr;csiz 1.5;cfg 2
60: gsb "SCL/AX"
61: if flg2;gsb "Pen"
62: for K=0 to V[3]
63: plt F[K]/1e9,A[K]
64: next K;pen;if flg2;gsb "Pen"
65: "Y-Axis Mks":ent "Y-value  [C]=Quit",B;if flg13;jmp 2
66: plt r5,B,-2;plt r2,B,-3;jmp -1
67: "X-Axis Mks":ent "X-value  [C]=Quit",B;if flg13;jmp 2
68: plt B,r3,-2;plt B,r4,-3;jmp -1
69: scl 0,10,0,10;if flg2;gsb "Pen"
70: csiz 2,1.5,8/11,0;plt 4,.5,3;lbl "FREQUENCY (GHz)"
71:
72: csiz 2.2,1.5,8/11,0;plt 3,9,3
73: if G=0;lbl "GIGA-TRONICS 1026  ",N$
74: if G=1;lbl "SYSTRON-DONNER 1626 ",N$
75: if G=2;lbl "HEWLETT-PACKARD 8673A",N$
76: plt 3,8.3,3;if L=1;lbl "MAXIMUM POWER OUTPUT at ",T$
77: if L=0;lbl "    POWER OUTPUT at ",T$
78: plt 9,9.5,3;csiz 1.3;lbl D$
79: cll 'Read Time'
80: csiz 2,1.5,8/11,90;plt .5,3,3;lbl "POWER OUTPUT (dBm)"
81: psc 16;ent "[C]=HDCPY 1=PRT",C;if flg13;0}C;psc 705;sfg 2
;gsb "Pen"
82: if C=1;gto "Write"
83: csiz 1.5;gto 60
84:
85: "Write":sfg 1;scl 0,10,0,10;gsb "DISP"
86: psc 16;if C=1;psc 705;scl 0,10,0,10
87: ent "X",U;ent "Y",V;plt U,V,3;ent "[C]=Repos 1=PRT",P;if
flg13;jmp 0
88: ent "Format? (1-8)",F,"Angle? 0=Hor 90=Vert",A
89: csiz F,1.5,8/11,A;ent "Label 80<Spaces",X$;plt U,V,3;lbl
X$
90: ent "[C]=CHG 1=Repeat 2=Cont 3=Quit",R;if flg13;0}R;gto "
DISP"
91: if R=1;plt U,V,3;lbl X$;plt 10,10,3;gto "DISP"
92: if R=2;lbl X$;jmp -2
93: if R=3;stp
94: "DISP":gclr;aclr ;psc 16;scl 0,10,0,10
95: plt .5,8;csiz 1;fxd 2;lbl "X =",X,"      Y =",Y
96: plt .5,7.5;csiz 2;lbl "U =",U,"      V =",V
97: plt .5,4;csiz 2;lbl "L Size =",F,"   Angle =",A
98: plt .5,3.5;csiz 1;lbl "X$ Label:";plt 1.7,3.5
99: lbl X$
```

```
100: if flg1;cfg 1;ret
101: gto 86
102:
103: "648":
104: data 100,99.7,98.8,99,98.6,97.9,97.8,97.6,97.4,97.1,97.1
,97.2,96.2,96
105: data 95.8,95.3,95,94.8,92.9,91.7,92.5,93.8,92.8,93.1,92.
2,91.6
106: for J=2 to 27;read Y[J];next J
107: ret
108: "163":
109: data 100.1,99.2,99,99.3,98.8,98.4,97.9,97.8,97.6,97.5,97
.1,97.4,96.7
110: data 96.1,95.2,95.5,95,95.1,93.7,92.8,92.9,92.6,91.3,91.
8,88.3,85.2
111: for J=2 to 27;read Y[J];next J
112: ret
113: "180":
114: data 99.2,98.6,98.8,98.5,98.2,97.9,97.6,97.2,97.3,97.2,9
6.8,97.5,96.9
115: data 96.5,95.6,95.8,95.5,95.5,94.3,93.2,93.1,93.2,92.3,9
2.4,88.6,83.4
116: for J=2 to 27;read Y[J];next J
117: ret
118:
119: "S/D":if I=1 and L=0;wrt M,"H001L0M0N0G0F0E0D0"
120: if I=1 and L=1;wrt M,"H001L0M?N0G0F0E0D0"
121: wait 100
122: fmt 1,"H",fz5.0,"L",fz1.0
123: wrt M+.1,1000F,5-W
124: wait 200;ret
125:
126: "G/T":if I=1 and L=0;wrt M,"GENFIXED MODOFF LEVEL",W
127: if I=1 and L=1;wrt M,"GENFIXED MODOFF LEVEL15"
128: fmt 2,"FA",f5.0
129: wrt M+.2,1000F
130: wait 200;ret
131:
132: "HP":if I=1;wrt M,"pl",W,"db"
133: fmt 3,"fr",f10.6,"gz"
134: wrt M+.3,F;wrt M+.3,F
135: wait 200;ret
136:
137: "CRT":psc 16;gclr;aclr ;fxd 0
138: V[2]-V[1]}r10;-.15r10+V[1]}r1;V[2]+.05r10}r2
139: ent "Output RANGE? (dBm) Top  [C]=+20",r4;if flg13;20}r4
140: ent "Output RANGE? (dBm) Bottom  [C]=-10",r3;if flg13;-1
0}r3
141: "SCL/AX":scl r1,r2,r3,r4
142: V[1]}r5;0}r6;1}r7;1}r8;5}r9
143: r4-r3}r11;fxd 0
144: if r11<=10;2}r9;.5}r8;fxd 0
145: if r11<=5;1}r9;fxd 1
146: if r11<=2;2}r9;.25}r8;fxd 2
147: if r3>0 or r4<0;ent "Y-intercept",r6
148: csiz 1.5;yax r5,r8,r3,r4,r9;fxd 0
149: if r10>=26;4}r12
```

```
150: if r10<26;5}r12
151: if r10<=10;2}r12;.5}r7;fxd 1
152: if r10<=1;1}r12
153: if r10<=2;.2}r7;fxd 1
154: if r10<1;.1}r7;fxd 1
155: csiz 1.5;xax r6,r7,V[1],V[2],r12
156: ret
157:
158: "Stat-GT":wrt M,"SENDSTATUS";red M,S$
159: val(S$[7,8])}U;val(S$[15,16])}V
160: fmt 8,"UNlevel at",f6.3
161: fmt 9,"UNlock at",f7.3
162: if U=0;wrt 16.9,F
163: if V=0;wrt 16.8,F
164: ret
165:
166: "Stat-SD":red M,U
167: fmt 8,c11," UNlevel at",f6.3
168: fmt 9,c11," UNlock at",f7.3
169: if U=1 or U=3;wrt 701.9,N$,F
170: if U=2 or U=3;wrt 701.8,N$,F
171: ret
172:
173: "COAX LOSS":if F<=.3 and D<=2;4F+.3}Z;ret
174: jmp D
175: "24-1":1.33+1.11F-.0787FF+FFF4.53e-3-1.36e-4F^4+1.71e-6F
^5}Z;ret
176: "24-2":1.18+1.21F-.115FF+FFF8.53e-3-3.14e-4F^4+4.4e-6F^5
}Z;ret
177: "6-3":.313+.273F-.0147FF+FFF6.26e-4-1.53e-5F^4+2.07e-7F
5}Z;ret
178: "6-4":.292+.311F-.0215FF+.00104FFF-2.52e-5F^4+2.74e-7F^5
}Z;ret
179:
180: "Stat-HP":rdb(M)}U;rdb(M)}U;if U=0;ret
181: if U=64;wrt 16,"UNlevel at",F
182: if U=16;wrt 16,"UNlocked at",F
183: ret
184:
185: "CF":if p1<=2;100}p2;ret
186: for J=2 to 26
187: if p1>=J;J}p3;Y[J]}p4;Y[J+1]}p5
188: next J
189: p4+(p1-p3)(p5-p4)}p2
190: ret
191:
192: "INIT":
193: "--- UUT Address":725}M
194: "--- UUT s/n":"s/n 281902"}N$
195: "--- COAX Index (1-4) 5=None":5}D;if D=5;0}Z
196: "--- Date":"4/12/83"}D$
197: "--- Temperature":"25'C"}T$
198: wrt 16.D$,"      UUT is ",N$
199: wrt 16
200: if D<=2;wrt 16,"24 ft Coax in use"
201: if D<=4;wrt 16,"6 ft Coax in use"
202: if D=5;wrt 16,"NO Coax used"
```

```
203: wrt 16
204: wrt 16,"Temp set to ",T$
205: ret
206:
207: "CLOCK":
208: "Set Time":
209: ent "Time? (hhmm.ss)",p1
210: int(p1/100)}p2;int(p1-100p2)}p3;100frc(p1)}p4
211: stime p4+p3*60+p2*60^2
212: ret
213:
214: "Read Time":
215: rtime}p1
216: int(p1/3600)}p2;p1-p2*60^2}p3
217: int(p3/60)}p4;p3-60*p4}p5
218: fxd 0;plt 9,9.2,3;csiz 1.2;lbl p2,":",p4,":",p5
219: ret
220:
221: "Pen":
222: ent "Pen # CHANGE?  0=NoPEN (1-4)  [C]=#1",P;if flg13;1}
P
223: pen# P;ret
```

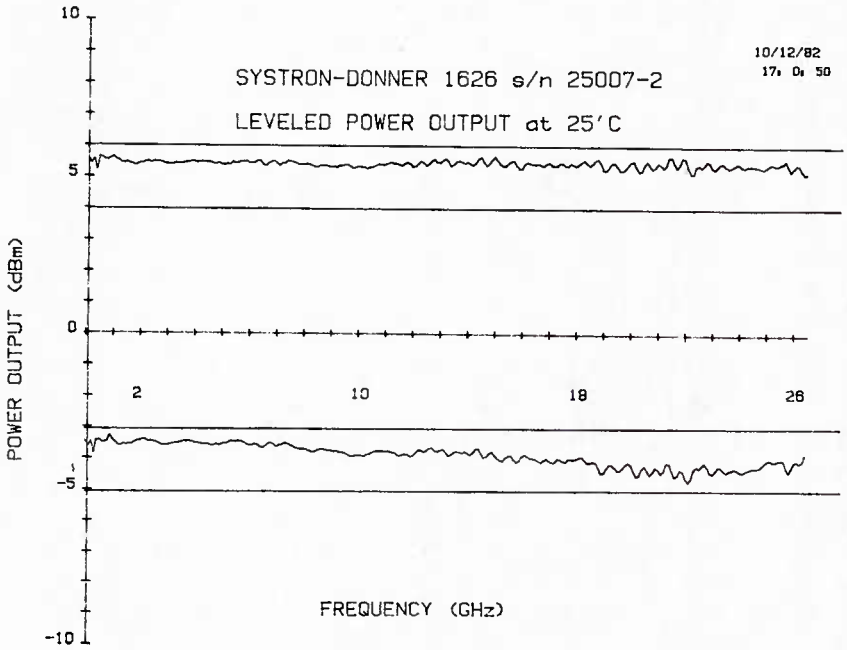


Fig. B/C2 — Sample data sheet (a) Systron-Donner 1626 s/n 25007-2; leveled power output at 25°C

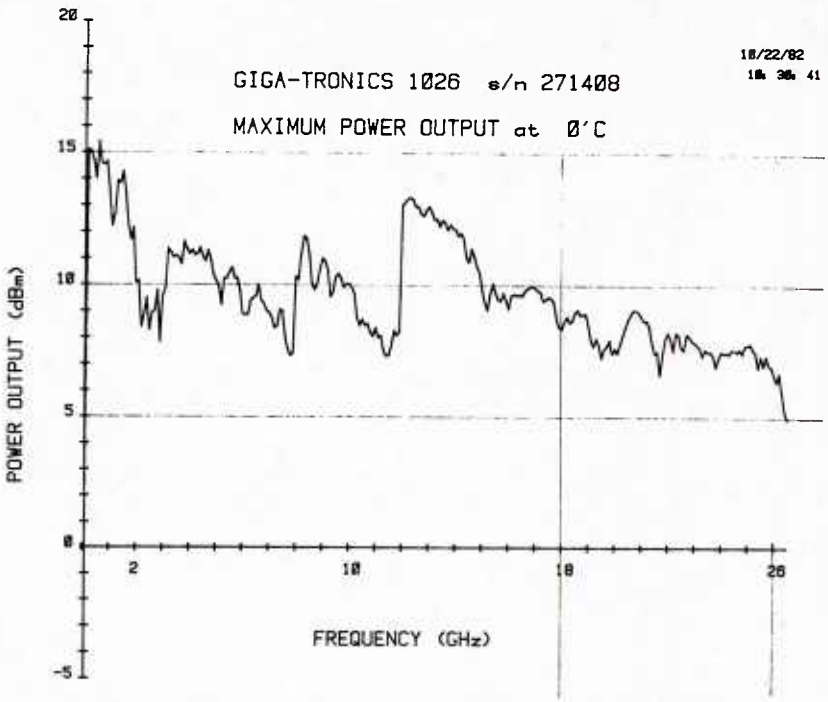


Fig. B/C2 — Sample data sheet (b) Giga-tronics 1026 s/n 271408; maximum power output at 0°C

Appendix D

LEVEL CALIBRATION TEST

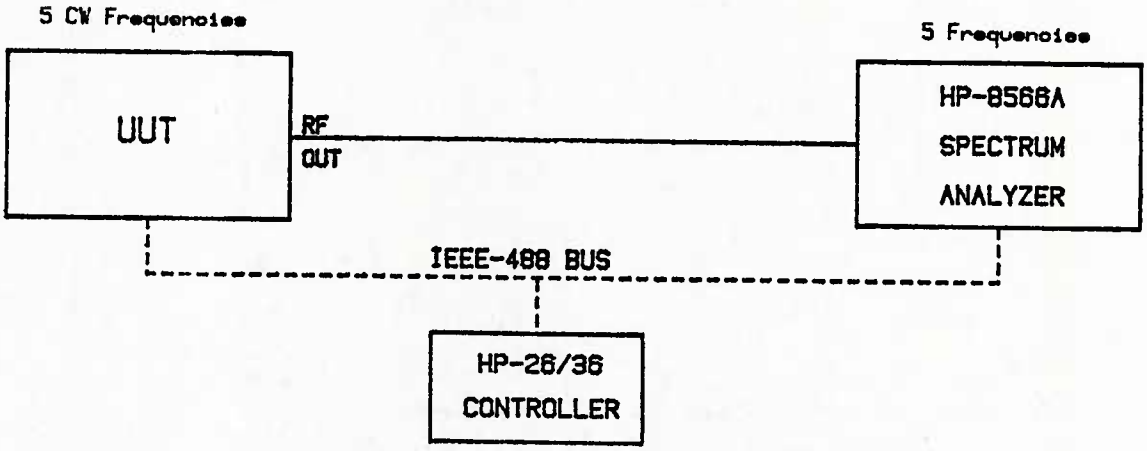


Fig. D1 — Level calibration test

LEVEL CALIBRATION TEST

Language: HPL Controller: HP-26/36

```
0: "ATTENUATION Measurement Readout [attenGT]":
1: "Author: JJO, 12/14/82; revise 2/9/83":
2: "Program reads out difference of marker ":
3: "on 8566 as attenuator is stepped":
4: "Flags: 1=Heading Prt  2=gsb'BW'  3=Calculate":
5: "Flags: 4=25videoAVE  5='BW'eachFREQ":
6:
7: "8566A":dev "sa",718
8: "2673A":dev "lp",701
9: "UUT":dev "uut",725
10:
11: dim L$[96],N$[15];buf "L",L$,3
12: dim F[20]
13: dim E$[20],S$[25],D$[10];aclr
14: ent "Print ALL? [C]=No 1=Yes",Q;if flg13;16}P
15: if Q=1;701}P;gto 17
16: ent "ERROR Output? [C]=Printer  0=Display",E;if flg13;701
}E
17: ent "Serial Number? xxxxxxx",N$;"s/n "&N$}N$
18: ent "Date? mo/day",D$;D$&"/83"}D$
19: ent "Which ATTEN? [C]=10dB/step 1=1dB/step",Q;if flg13;0}
Q;-90}X;-10}Y
20: if Q=1;-99}X;-1}Y
21: fmt ;fxd 2
22:
23: data .1,2,9,18,22
24: for J=1 to 5;read F[J];next J
25: ent "Enter FREQs? [C]=No 1=Yes",Q;if flg13;0}Q;5}N
26: if Q=1;gsb "ENTER"
27: oni 7,"*INTERRUPT";eir 7
28: aclr ;sfg 1
29: cli 7;clr "sa";llo 7;10}A;wrt "sa","TS";cfg 3
30: pbeep 500,1;wait 2000
31:
32: for I=1 to N
33: sfg 2,5
34: wrt "sa","IP TS"
35: gsb "FREQ"
36: wrt "sa","RL 0 DM"
37: wrt "sa","M1 TS TS"
38: fmt 5,f.4,c,z
39: wrt "sa.5","CF",F[I],"GZ"
40: wrt "sa","SP MZ TS TS TS";wait 500
41: wrt "sa","M2 E1 TS TS TS"
42: '*MF'}M
43: wait 1000
44: wrt "sa","M3 TS"
45: for A=0 to X by Y
46: gsb "GT Level"
```

```
47: if flg2;if A<=-80 and F[I]<2;gto "BW"
48: if A<-80 and F[I]<2;gsb "VIDEOave"
49: if flg2;if A<=-70 and F[I]>=2;gto "BW"
50: if A<-80 and F[I]>18;sfg 4;gsb "VIDEOave"
51: if flg4;gto 57
52: if A<-70 and F[I]>=2;gsb "VIDEOave"
53: if flg2;if A<=-60 and F[I]>12;gto "BW"
54: if A<-60 and F[I]>12;gsb "VIDEOave"
55: if flg2;if A<=-50 and F[I]>18;gto "BW"
56: if A<-55 and F[I]>18;gsb "VIDEOave"
57: wait 1000
58: wrt "sa","E1 TS TS"
59: wrt "sa","E1 TS TS"
60: '*MA'}C
61: wrt "sa","KSH TS"
62:
63: "PRINTOUT":
64: fmt 5,"   OUTPUT ATTENUATION CHECK",c12
65: fmt 4,"  GIGA-TRONICS 1026",c15
66: fmt 1,"   Freq    Nom Level   Meas Level   Diff"
67: fmt 2,"   (GHz)     (dB)         (dB)      (dB)"
68: if flg1;wrt E+.5,D$;wrt E+.4,N$;wrt E+.1;wrt E+.2
69: if flg1;cfg 1;wrt P+.5,D$;wrt P+.4,N$;wrt P+.1;wrt P+.2
70: fmt 3,f8.3,f10.1,2x,f10.1,x,f8.1
71: if flg3 and abs(A-C-Z)>1.5;wrt E+.3,M/1e9,A,C+Z,A-C-Z
72: if flg3;wrt P+.3,M/1e9,A,C+Z,A-C-Z;jmp 3
73: if abs(A-C)>1.5;wrt E+.3,M/1e9,A,C,A-C
74: wrt P+.3,M/1e9,A,C,A-C
75: next A;0}Z;cfg 3,4
76: next I
77: dsp "Finished"
78: fmt 7,/,"ATTENUATOR Check Complete; Errors > 1.5 dB shown
 above";wrt E+.7
79: fmt 7,c14,5f8.3;wrt E+.7,"Freqs Checked:",F[1],F[2],F[3],
F[4],F[5]
80: if N>5;fmt 7,5x,7f8.3;wrt E+.7,F[6],F[7],F[8],F[9],F[10],
F[11],F[12]
81: for J=1 to 10;pbeep 200J,1;next J
82: end
83: "--------------- Subroutines ---------------":
84: "BW":cfg 2;sfg 3
85: if flg5;A+10}A}Z;gsb "GT Level"
86: wrt "sa","RL-40DM"
87: wrt "sa","M1 TS"
88: wrt "sa","SP20KZ"
89: wrt "sa","M2 E1 TS"
90: wrt "sa","E2 TS TS TS"
91: wrt "sa","E1 TS TS TS "
92: wait 1000;cfg 5
93: wrt "sa","M3 TS"
94: gto 60
95:
96: "VIDEOave":
97: if flg4;wrt 718,"KSG 25 HZ";jmp 2
98: wrt 718,"KSG 10 HZ"
99: wrt "sa","TS"
100: ret
101:
```

```
102: "FREQ":
103: fmt 9,"GENFIXED MODOFF LEVEL0 FA",f5.0
104: wrt "uut.9",1000F[I]
105: ret
106:
107: "GT Level":
108: fmt 8,"LEVEL",f5.1;wrt "uut.8",A;ret
109:
110: "ENTER":
111: 1+I}I;ent "Freq? (GHz)  [C]=Quit",F[I];if flg13;aclr ;I-
1}N;ret
112: fmt 6,f3.0,2x,f8.3,c4;wrt 16.6,I,F[I],"GHz";jmp -1
113: "*************** Subprograms ***************";
114: "*INTERRUPT":
115: if not bit(6,rds("sa")}R);gto +5
116: if bit(1,R);gto +4
117: if bit(3,R);aclr ;gclr;wrt 16,"HARDWARE BROKEN!";gto +2
118: if bit(5,R);aclr ;beep;wrt 16,"ILLEGAL COMMAND!"
119: stp ;eir 7;iret
120: eir 7;iret
121: "END *INTERRUPT":
122:
123: "*MA/*MF":
124:
125: "*MA":"03MA"}S$;"*MA"}E$;gto +3
126:
127: "*MF":"03MF"}S$;"*MF"}E$;if p1=4;jmp 8
128: if not p0;3}p1;gto +3
129: if p0>1 or p1<1 or p1>4;jmp 9
130: char(48+p1)}S$[2,2]
131: cll '*SAVE';if ('.nL$'(63)}p0)=0;2}p3;jmp 7
132: wtb "sa",S$;if p1=1 or p1=3;red "sa",p2;jmp 2
133: rdb("sa")}p2;if p1=2;rot(p2,8)+rdb("sa")}p2
134: if p1=3 or p0#19;jmp 3
135: if p1=4;3}p3;jmp 3
136: if p2>1024;p2-4096}p2
137: ret p2
138: cll '*ERR'(p3);ret 0
139: "END *MA/*MF":
140:
141: "*SAVE/*RECALL":
142: "*SAVE":
143: if p0;"*SAVE"}E$;cll '*ERR';ret
144: rem "sa";buf "L";wtb "sa","OL";tfr "sa","L",80
145: jmp rds("L")=80
146: rem "sa";if '.nL$'(80)#162;1}p0;jmp -3
147: ret
148: "*RECALL":
149: if not p0;if '.nL$'(1)=31;if '.nL$'(80)=162;gto +2
150: "*RECALL"}E$;cll '*ERR';ret
151: rem "sa";wtb "sa",L$,"HD"
152: ret
153:
154: ".nL$":ret shf(num(L$[p1,p1]),p2)
155: "END *SAVE/*RECALL":
156: "END OF PROGRAM":
```

```
   OUTPUT ATTENUATION CHECK      4/19/83
  GIGA-TRONICS 1026      s/n 281902
   Freq     Nom Level    Meas Level    Diff
   (GHz)      (dB)          (dB)       (dB)
  18.000      -90.0        -88.3      -1.7

ATTENUATOR Check Complete; Errors > 1.5 dB shown above
Freqs Checked:   0.100   2.000   9.000  18.000  22.000


   OUTPUT ATTENUATION CHECK      4/19/83
  GIGA-TRONICS 1026      s/n 281902
   Freq     Nom Level    Meas Level    Diff
   (GHz)      (dB)          (dB)       (dB)
  17.000      -90.0        -88.1      -1.9

ATTENUATOR Check Complete; Errors > 1.5 dB shown above
Freqs Checked:  17.000  17.500  18.000  18.500  19.000
```

```
   OUTPUT ATTENUATION CHECK      4/19/83
  GIGA-TRONICS 1026      s/n 281906
   Freq     Nom Level    Meas Level    Diff
   (GHz)      (dB)          (dB)       (dB)

ATTENUATOR Check Complete; Errors > 1.5 dB shown above
Freqs Checked:   0.100   2.000   9.000  18.000  22.000
```

Fig. D2 — Sample data sheet

Appendix E

SPUR HUNT TEST

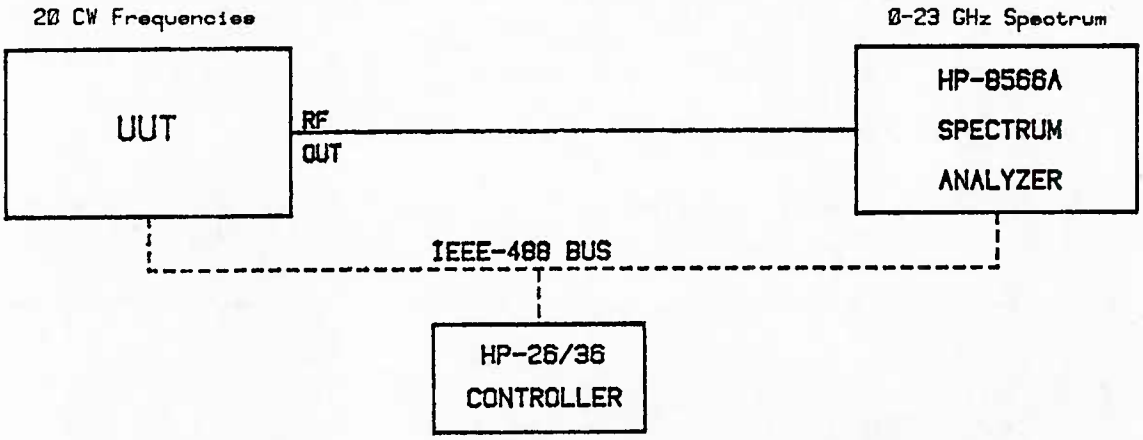


Fig. E1 — Spurious response test; harmonic/nonharmonic outputs

SPURIOUS RESPONSE TEST

Language: HPL Controller: HP-26/36

```
0: "8566A SPUR HUNT PROGRAM - [spur*GT]":
1: "Author: JJO, 11/20/82 ; revised 12/13/82":
2: " Program sets G/T 1626 Sig Gen to 20 freqs":
3: "(picked at random); then searches spectrum":
4: "in 1 GHz increments for any outputs >-55 dBm":
5:
6: "8566A":dev "sa",718
7: "2673A":dev "lp",701
8: "UUT":dev "uut",725
9:
10: dim L$[96];buf "L",L$,3;aclr :gclr
11: dim E$[20],S$[25],T$[30],D$[10],N$[10]
12: dim F[20];"SPUR HUNT (0-23 GHz Spectrum) "}T$
13:
14: ent "Date? mo/day",D$;D$&"/83"}D$
15: ent "UUT serial number? xxxxxx",N$
16: ent "OUTPUT? [C]=Hardcopy 16=CRT",P;if flg13;701}P
17: fmt ;fxd 2
18:
19: oni 7,"*INTERRUPT";eir 7
20: cli 7;clr "sa";wrt "sa","TS"
21: ent "CRT On? [C]=Yes 1=No",Q;if flg13;0}Q
22: if Q=1;wrt "sa","KSg"
23: .105}F[1];.581}F[2];1.17}F[3];1.513}F[4];2.409}F[5];3.536
}F[6];4.814}F[7]
24: 5.791}F[8];6.869}F[9];8.075}F[10];9.182}F[11];11.406}F[12
];13.317}F[13]
25: 15.421}F[14];17.361}F[15];19.425}F[16];21.833}F[17];23.64
7}F[18]
26: 24.088}F[19];25.792}F[20]
27: aclr ;gsb "HEADING"
28:
29: for I=1 to 20
30: F[I]}C
31: "UUT Freq":fmt 1,"GENFIXED MODOFF FA",f5.0;wrt "uut.1",10
00C
32: "UUT Amp":wrt "uut","GENFIXED LEVEL",0
33: "Title":wrt "sa","KSE",T$
34: fxd 3;dsp "F =",C," GHz";wait 2000
35: fxd 3;fmt 7,"1026 Set Freq = ",f7.3," GHz";wrt P+.7,C
36: wrt "sa","A1 B4 S1"
37:
```

```
38: for J=1 to 23
39: gsb "WINDOW"
40: wrt "sa","M1 TS TS"
41: wrt "sa","M2 E1 TS TS"
42: wait 200
43: wrt "sa","E1 TS TS"
44: "R":'*MA'}L
45: wait 100
46: if L>=-55;gsb "BW"
47: if L>=-55;gsb "MEAS"
48: if L>=-55;beep;gsb "PRINT"
49: if L>=-55;gto "NextPEAK"
50: if L<-55;0}K;next J
51: next I
52: pbeep 200,1;dsp "FINISHED";stp
53:
54: "/////////////// Subroutines ///////////////":
55: "NextPEAK":wrt "sa","M1 TS"
56: gsb "WINDOW"
57: wrt "sa","M2 E1 TS"
58: wait 500
59: wrt "sa","E1 TS"
60: pbeep 1000,1
61: if K>=0;wrt "sa","KSK TS"
62: if K>=0;pbeep 500,1;if K=0;gto 74
63: if K>=1;wrt "sa","KSK TS"
64: if K>=1;pbeep 400,1;if K=1;gto 74
65: if K>=2;wrt "sa","KSK TS"
66: if K>=2;pbeep 300,1;if K=2;gto 74
67: if K>=3;wrt "sa","KSK TS"
68: if K>=3;pbeep 200.1;if K=3;gto 74
69: if K>=4;wrt "sa","KSK TS"
70: if K>=4;pbeep 100,1;if K=4;gto 74
71: if K>=5;wrt "sa","KSK TS"
72: if K>=5;pbeep 80,1;if K=5;gto 74
73: wrt 16,"More than 5 signals above -55 dBm";stp
74: 1+K}K;gto "R"
75:
```

```
"MEAS":
wrt "sa","E1 TS TS"
wrt "sa","E1 TS TS"
wrt "sa","E2 TS TS TS"
wait 1000
wrt "sa","SP20MZ TS TS"
wrt "sa","E1 TS TS"
wrt "sa","E1 TS TS"
'*MA'}L
'*MF'}F
if int(F/1e7)=int(Z/1e7);-60}L
F}Z
ret

"PRINT":
F/1e9}F;if F<.01;ret
fmt 2,f12.6,5x,f8.2;wrt P+.2,F,L;ret

"HEADING":
wrt P," SPUR HUNT TEST      ",D$
wrt P,"GIGA-TRONICS 1026     s/n ",N$
wrt P,"-----------------------------------"
wrt P,"   Freq (GHz)     Level (dBm)"
wrt P,"-----------------------------------"
ret

"WINDOW":
fmt 1,f.4,c,z
if J=1;wrt "sa","FA10MZ TS TS";jmp 2
wrt "sa.1","FA",J-1,"GZ TS TS"
wrt "sa.1","FB",J,"GZ TS TS"
wrt "sa","RB 3MZ TS TS"
ret

"BW":
wrt "sa","RB 300KZ TS TS TS"
wrt "sa","E1 TS TS E1 TS TS"
'*MA'}L
ret
```

```
"*************** Subprograms **************";

"*INTERRUPT":
if not bit(6,rds("sa")}R);gto +5
if bit(1,R);gto +4
if bit(3,R);prt "HARDWARE BROKEN!";gto +2
if bit(5,R);prt "ILLEGAL COMMAND!"
stp ;eir 7;iret
eir 7;iret
"END *INTERRUPT":

"*MA/*MF":
"EXT's: dev'sa'; E$; S$; *ERR; *SAVE":

"*MA":"03MA"}S$;"*MA"}E$;gto +3

"*MF":"03MF"}S$;"*MF"}E$;if p1=4;jmp 8
if not p0;3}p1;gto +3
if p0>1 or p1<1 or p1>4;jmp 9
char(48+p1)}S$[2,2]
cll '*SAVE';if ('.nL$'(63)}p0)=0;2}p3;jmp 7
wtb "sa",S$;if p1=1 or p1=3;red "sa",p2;jmp 2
rdb("sa")}p2;if p1=2;rot(p2,8)+rdb("sa")}p2
if p1=3 or p0#19;jmp 3
if p1=4;3}p3;jmp 3
if p2>1024;p2-4096}p2
ret p2
cll '*ERR'(p3);ret 0
"END *MA/*MF":

"*ERR":
fxd 0;spc 1;aclr ;gclr;wrt 16,"error",E$&str(-max(p1,1))
stp ;ret
"END *ERR":

"*SAVE/*RECALL":
"*SAVE":
if p0;"*SAVE"}E$;cll '*ERR';ret
rem "sa";buf "L";wtb "sa","OL";tfr "sa","L",80
jmp rds("L")=80
rem "sa";if '.nL$'(80)#162;1}p0;jmp -3
ret

"*RECALL":
if not p0;if '.nL$'(1)=31;if '.nL$'(80)=162;gto +2
"*RECALL"}E$;cll '*ERR';ret
rem "sa";wtb "sa",L$,"HD"
ret

".nL$":ret shf(num(L$[p1,p1]),p2)
"END *SAVE/*RECALL":
"END OF PROGRAM":
```

SPUR HUNT TEST 4/18/83
GIGA-TRONICS 1026 s/n 281906

Freq (GHz)	Level (dBm)
1026 Set Freq = 0.105 GHz	
0.105000	0.30
1026 Set Freq = 0.581 GHz	
0.581000	-0.10
1026 Set Freq = 1.170 GHz	
1.169980	-0.20
1026 Set Freq = 1.513 GHz	
1.513040	-0.50
1026 Set Freq = 2.409 GHz	
2.409040	-0.40
1026 Set Freq = 3.536 GHz	
3.536000	-0.90
1026 Set Freq = 4.814 GHz	
4.814060	-0.50
1026 Set Freq = 5.791 GHz	
5.790940	-7.00
1026 Set Freq = 6.869 GHz	
6.869000	-1.80
1026 Set Freq = 8.075 GHz	
8.074960	-1.60
1026 Set Freq = 9.182 GHz	
9.181980	-1.60
1026 Set Freq = 11.406 GHz	
11.406000	-1.20
1026 Set Freq = 13.317 GHz	
13.316960	-2.60
1026 Set Freq = 15.421 GHz	
15.420960	-2.20
1026 Set Freq = 17.361 GHz	
17.361060	-2.90
1026 Set Freq = 19.425 GHz	
19.424960	-1.80
1026 Set Freq = 21.833 GHz	
21.832960	-4.50
1026 Set Freq = 23.647 GHz	
1026 Set Freq = 24.088 GHz	
7.901620	-54.10
1026 Set Freq = 25.792 GHz	
8.501620	-53.80
20.697860	-49.00
21.212160	-51.90

Fig. E2 — Sample data sheet

Appendix F

PHASE NOISE TEST

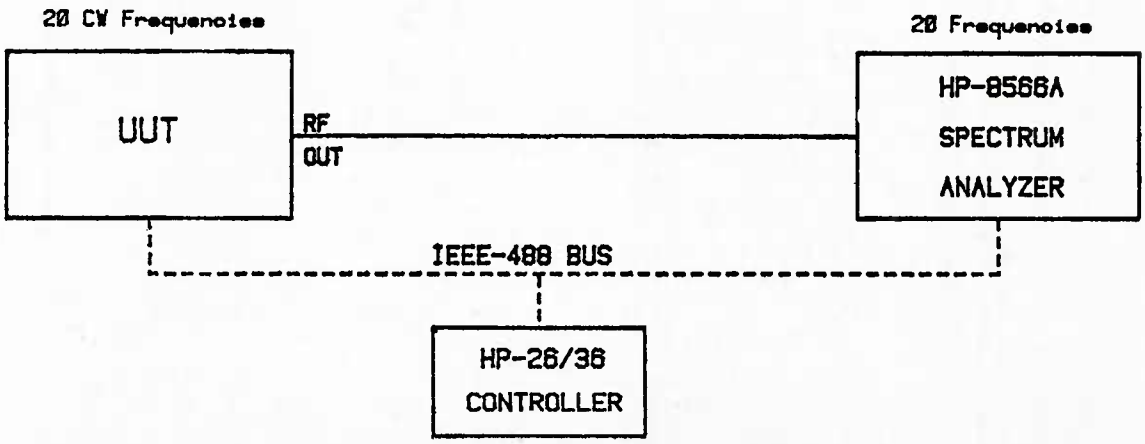


Fig. F1 — Phase noise test; 10 kHz offset

PHASE NOISE TEST

Language: HPL Controller: HP-26/36

```
0: "PHASE NOISE (10 KHz Offset)  [OnoiseSD]":
1: "Author: JJO, 11/18/82":
2: " For SD1626 phase noise measured at an ":
3: "offset of 10 KHz from carrier in dBc/Hz":
4:
5:
6: "8566A":dev "sa",718
7: "2673A":dev "lp",701
8: "UUT":dev "uut",725
9:
10: dim L$[96],K$[80];buf "L",L$,3
11: dim R$[1,80],D$[10],N$[15]
12: dim E$[20],S$[25],F[50]
13: ent "Date? mo/day",D$;D$&"/83"}D$
14: ent "UUT serial number? 2xxxxx",N$;"s/n 2"&N$}N$
15: ent "PRINTER?  [C]=2673  16=CRT",P;if flg13;701}P
16:
17: .105}F[1];.581}F[2];1.17}F[3];1.513}F[4]
18: 1.996}F[5];2.409}F[6];3.536}F[7];4.814}F[8]
19: 5.791}F[9];6.469}F[10];7.219}F[11]
20: 8.075}F[12];9.182}F[13];10.856}F[14];11.406}F[15];12.317}
F[16]
21: 13.159}F[17];14.983}F[18];15.545}F[19];16.734}F[20];17.36
1}F[21]
22: 18.676}F[22];19.308}F[23];20.164}F[24];21.833}F[25]
23: fmt ;fxd 2
24:
25: oni 7,"*INTERRUPT";eir 7
26: aclr ;sfg 1
27: cli 7;clr "sa";llo 7;wrt "sa","TS"
28: for I=1 to 25
29: F[I]}C
30: "UUT Freq":fmt 9,"01N0H",fz5.0;wrt "uut.9",1000C
31: "UUT Amp":wrt "uut","L5M0"
32: if I=1;wait 2000
33: if C<2;wrt "sa","LF TS"
34: if C>=2;wrt "sa","IP TS"
35: wrt "sa","E1 MT1 TS"
36: wrt "sa","SP MZ TS"
37: wrt "sa",".1MZ TSTSTSTS"
38: '*MA'}A
39: '*MF'}F
40: wrt "sa","M3 TS"
41: wrt "sa","10KZ TS"
42: wrt "sa","KSG M3";wait 5000
43: wrt "sa","M2 KSM";wait 2000
44: '*MA'}N
```

```
45: fmt 4," SYSTRON-DONNER 1626",c15,2x,c10
46: fmt 3,"   PHASE NOISE at 10 KHz OFFSET from CARRIER",/
47: fmt 1,"   Freq    Carrier  10KHz Oset  Phase Noise"
48: fmt 2,"   (GHz)     (dBm)    (dBm/Hz)    (dBc/Hz)"
49: if flg1;wrt P+.4,N$,D$;wrt P+.3
50: if flg1;cfg 1;wrt P+.1;wrt P+.2
51: fmt 3,f8.3,f8.1,3x.f8.1,4x,f8.1
52: wrt P+.3,F/1e9,A,N,N-A
53: next I
54: if P=16;dsp "Set Printer Paper / Press PRINTER [RESET] /
[C]";stp
55: if P=16;adump "lp"
56: dsp "Finished";stp
57:
58: "********************* Subprograms *********************":
59: "*INTERRUPT":
60: if not bit(6,rds("sa")}R);gto +5
61: if bit(1,R);gto +4
62: if bit(3,R);aclr ;gclr;wrt 16,"HARDWARE BROKEN!";gto +2
63: if bit(5,R);aclr ;beep;wrt 16,"ILLEGAL COMMAND!"
64: stp ;eir 7;iret
65: eir 7;iret
66: "END *INTERRUPT":
67:
68: "*MA/*MF":
69: "*MA":"O3MA"}S$;"*MA"}E$;gto +3
70:
71: "*MF":"O3MF"}S$;"*MF"}E$;if p1=4;jmp 8
72: if not p0;3}p1;gto +3
73: if p0>1 or p1<1 or p1>4;jmp 9
74: char(48+p1)}S$[2,2]
75: cll '*SAVE';if ('.nL$'(63)}p0)=0;2}p3;jmp 7
76: wtb "sa",S$;if p1=1 or p1=3;red "sa",p2;jmp 2
77: rdb("sa")}p2;if p1=2;rot(p2,8)+rdb("sa")}p2
78: if p1=3 or p0#19;jmp 3
79: if p1=4;3}p3;jmp 3
80: if p2>1024;p2-4096}p2
81: ret p2
82: cll '*ERR'(p3);ret 0
83: "END *MA/*MF":
84:
85: "*SAVE/*RECALL":
86: "*SAVE":
87: if p0;"*SAVE"}E$;cll '*ERR';ret
88: rem "sa";buf "L";wtb "sa","OL";tfr "sa","L",80
89: jmp rds("L")=80
90: rem "sa";if '.nL$'(80)#162:1}p0;jmp -3
91: ret
92: "*RECALL":
93: if not p0;if '.nL$'(1)=31;if '.nL$'(80)=162;gto +2
94: "*RECALL"}E$;cll '*ERR';ret
95: rem "sa";wtb "sa",L$,"HD"
96: ret
97: ".nL$":ret shf(num(L$[p1,p1]),p2)
98: "END *SAVE/*RECALL":
99: "END OF PROGRAM":
```

GIGA-TRONICS 1026 s/n 281902 4/18/83
PHASE NOISE at 10 KHz OFFSET from CARRIER

Freq (GHz)	Carrier (dBm)	10KHz Oset (dBm/Hz)	Phase Noise (dBc/Hz)
0.105	-0.1	-74.5	-74.4
0.581	0.0	-75.2	-75.2
1.170	-0.1	-75.6	-75.5
1.513	0.1	-75.4	-75.5
1.996	-0.2	-77.5	-77.3
2.409	-0.4	-79.9	-79.5
3.536	-1.0	-78.8	-77.8
4.814	-0.6	-79.5	-78.9
5.791	-2.6	-78.6	-76.0
6.469	-3.0	-79.2	-76.2
7.219	-2.4	-81.7	-79.3
8.075	-1.8	-76.8	-75.0
9.182	-1.9	-76.9	-75.0
10.856	-1.6	-77.0	-75.4
11.406	-1.1	-77.8	-76.7
12.317	-1.8	-76.0	-74.2
13.159	-2.2	-77.1	-74.9
14.983	-2.1	-78.1	-76.0
15.545	-1.5	-77.4	-75.9
16.734	-2.9	-71.5	-68.6
17.361	-2.1	-66.1	-64.0
18.676	-2.6	-77.5	-74.9
19.308	-2.2	-79.0	-76.8
20.164	-3.8	-77.2	-73.4
21.833	-5.3	-79.4	-74.1

Fig. F2 — Sample data sheet

Appendix G

ON/OFF RATIO TEST

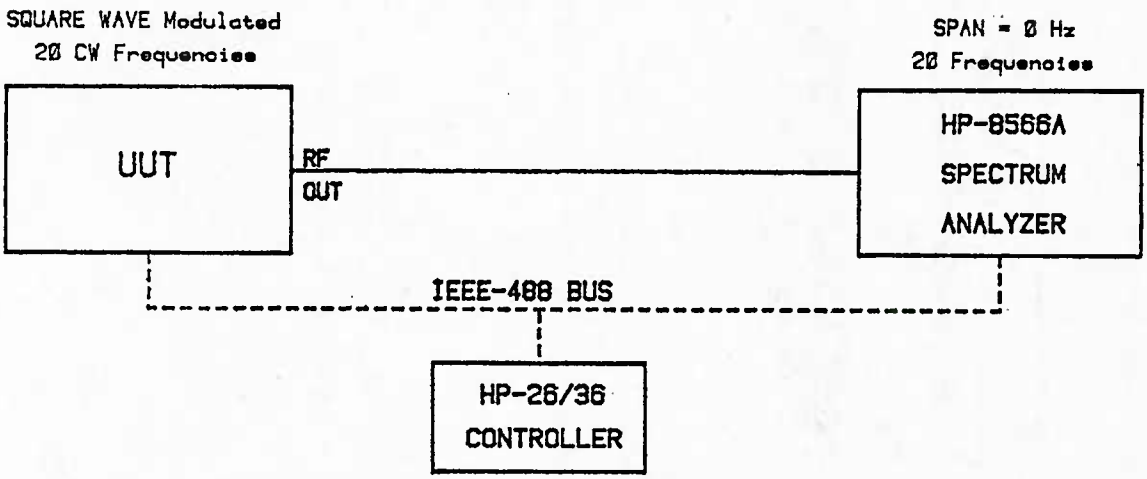


Fig. G1 — On/off ratio test; pulse or square wave modulation

ON/OFF RATIO TEST

Language: HPL Controller: HP-26/36

```
0: "PULSE MODULATION ON/OFF RATIO - [on/offGT]";
1: "Author: JJO, 7/16/82":
2: " Program sets G/T 1026 Sig Gen to 20 freqs":
3: "applies SQ WAVE modulation at 0 dBm; uses spectrum":
4: "analyzer to measure ratio":
5:
6: "8566A":dev "sa",718
7: "2673A":dev "lp",701;701}P
8: "7470A":dev "gp",705;psc 705;dim H[2],H$[50],X$[30],Y$[30]
9: dim L$[96],K$[80];buf "L",L$,3;aclr ;gclr
10: dim R$[1,80],E$[20],S$[25],T$[30],D$[10],N$[10]
11: dim F[20],L[20,0:6],M[20,0:6];"PULSE MOD On/Off Ratio
    "}T$
12:
13: ent "Date? mo/day",D$;D$&"/82"}D$
14: ent "UUT serial number? 27xxxx",N$;"27"&N$}N$
15: "Printer";16}P
16: fmt ;fxd 2
17: oni 7,"*INTERRUPT";eir 7
18: cli 7;clr "sa";llo 7;wrt "sa","TS"
19: .241}F[1];1.177}F[2];1.813}F[3];2.209}F[4];4.814}F[5]
20: 6.869}F[6];9.182}F[7];11.406}F[8];12.317}F[9]
21: 15.421}F[10];17.361}F[11];19.225}F[12];21.833}F[13]
22: aclr ;gsb "HEADING"
23:
24: for I=1 to 13
25: F[I]}C
26: "UUT Freq":fmt 1,"GENFIXED FA",f5.0;wrt 725.1,1000C
27: "UUT Amp":wrt 725,"LEVEL0"
28: "UUT Sq Wave":wrt 725,"MODSQR MODRATEFIXED"
29: "Title":wrt "sa","KSE",T$&D$
30: fxd 3;dsp "F =",C," GHz"
31:
32: "START":if C<2;gsb "Lwide"
33: if C>=2;gsb "Hwide"
34: wait 1000
35: wrt "sa","CF",C,"GZ TS"
36: wrt "sa","SP0HZ TS"
37: wrt "sa","ST20MS TS"
38: wrt "sa","A4 B1 T4 TS"
39: wrt "sa","B3 M2 E1 M3"
40: lcl "sa"
41: beep;dsp "Turn S/A KNOB: Markers at Top/Bottom of Sq Wave
";stp
42: rem "sa"
43: '*MA'}R;R+T}T
44: gsb "PRINT"
45: next I
46: pbeep 200,1;dsp "FINISHED  [C] for Hardcopy";stp
47: adump "lp"
48: dsp "Hardcopy Completed";stp
```

```
"/////////////// Subroutines ///////////////":
"Lwide":wrt "sa","LF";ret
"Hwide":wrt "sa","IP";ret
"PRINT":
fmt 1,f10.3,7x,f8.2,"    Ave = ",f6.2," dBm"
if I=13;wrt 16.1,C,R,T/13;ret
fmt 2,f10.3,7x,f8.2;wrt 16.2,C,R;ret
"HEADING":
wrt P," PULSE On/Off RATIO TEST  ",D$
wrt P,"GIGA-TRONICS 1026   s/n ",N$
wrt P,"----------------------------------"
wrt P,"   Freq (GHz)     Ratio (dBm)"
wrt P,"----------------------------------"
ret
"*************** Subprograms **************":
"*INTERRUPT":
if not bit(6,rds("sa")}R);gto +5
if bit(1,R);gto +4
if bit(3,R);prt "HARDWARE BROKEN!";gto +2
if bit(5,R);prt "ILLEGAL COMMAND!"
stp ;eir 7;iret
eir 7;iret
"END *INTERRUPT":
"*MA/*MF":
"EXT's: dev'sa'; E$; S$; *ERR; *SAVE":

"*MA":"03MA"}S$;"*MA"}E$;gto +3

"*MF":"03MF"}S$;"*MF"}E$;if p1=4;jmp 8
if not p0;3}p1;gto +3
if p0>1 or p1<1 or p1>4;jmp 9
char(48+p1)}S$[2,2]
cll '*SAVE';if ('.nL$'(63)}p0)=0;2}p3;jmp 7
wtb "sa",S$;if p1=1 or p1=3;red "sa",p2;jmp 2
rdb("sa")}p2;if p1=2;rot(p2,8)+rdb("sa")}p2
if p1=3 or p0#19;jmp 3
if p1=4;3}p3;jmp 3
if p2>1024;p2-4096}p2
ret p2
cll '*ERR'(p3);ret 0
"END *MA/*MF":
"*ERR":
fxd 0;spc 1;aclr ;gclr;wrt 16,"error",E$&str(-max(p1,1))
stp ;ret
"END *ERR":
"*SAVE/*RECALL":
"*SAVE":
if p0;"*SAVE"}E$;cll '*ERR';ret
rem "sa";buf "L";wtb "sa","OL";tfr "sa","L",80
jmp rds("L")=80
rem "sa";if '.nL$'(80)#162;1}p0;jmp -3
ret
"*RECALL":
if not p0;if '.nL$'(1)=31;if '.nL$'(80)=162;gto +2
"*RECALL"}E$;cll '*ERR';ret
rem "sa";wtb "sa",L$,"HD"
ret
".nL$":ret shf(num(L$[p1,p1]),p2)
"END *SAVE/*RECALL":
"END OF PROGRAM":
```

PULSE On/Off RATIO TEST 4/19/83
GIGA-TRONICS 1026 s/n 281906

Freq (GHz)	Ratio (dBm)	
0.241	86.20	
1.177	61.00	
1.813	56.20	
2.209	70.10	
3.773	62.70	
4.814	63.10	
5.502	81.50	
6.669	54.50	
7.643	79.40	
8.813	46.60	
9.182	47.60	
10.482	46.70	
11.406	46.70	
12.317	37.90	
13.228	41.50	
14.944	40.30	
15.421	39.60	
16.169	35.80	
17.258	31.80	
18.157	42.80	
19.225	49.80	
20.643	45.80	
21.833	-62.90	Ave = 53.50 dBm

PULSE On/Off RATIO TEST 4/19/83
GIGA-TRONICS 1026 s/n 281902

Freq (GHz)	Ratio (dBm)	
0.241	61.40	
1.177	62.60	
1.813	56.60	
2.209	69.60	
3.773	62.80	
4.814	62.30	
5.502	64.40	
6.669	55.80	
7.643	57.00	
8.813	46.90	
9.182	47.30	
10.482	47.20	
11.406	47.80	
12.317	37.30	
13.228	40.00	
14.944	38.60	
15.421	37.50	
16.169	35.20	
17.258	30.60	
18.157	40.30	
19.225	41.80	
20.643	40.20	
21.833	37.90	Ave = 48.74 dBm

Fig. G2 — Sample data sheet

Appendix H

SWEEP OUTPUT TEST

(1) Connect A-P / Measure RF Out during Manual Sweep

(2) Connect B-P / Measure Ramp Out during Manual Sweep

(3) Connect A-P / Measure RF Out at 20 CW Steps across Sweep Range

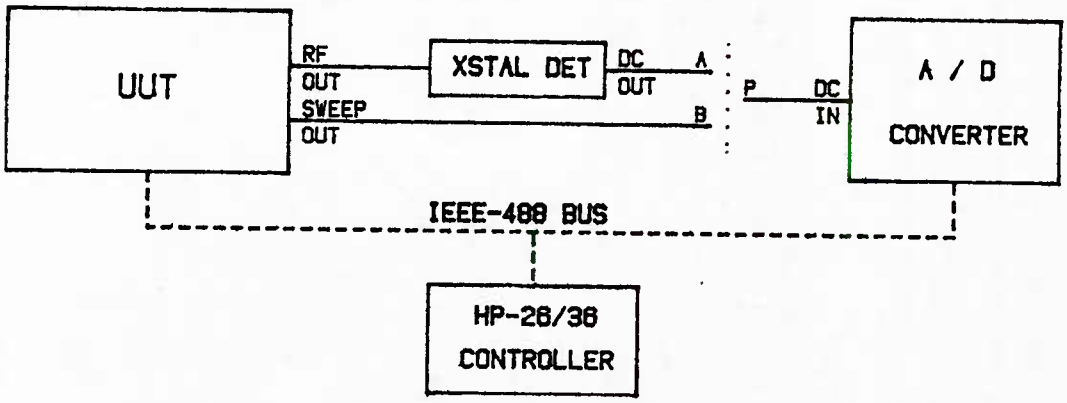


Fig. H1 — Sweep output test

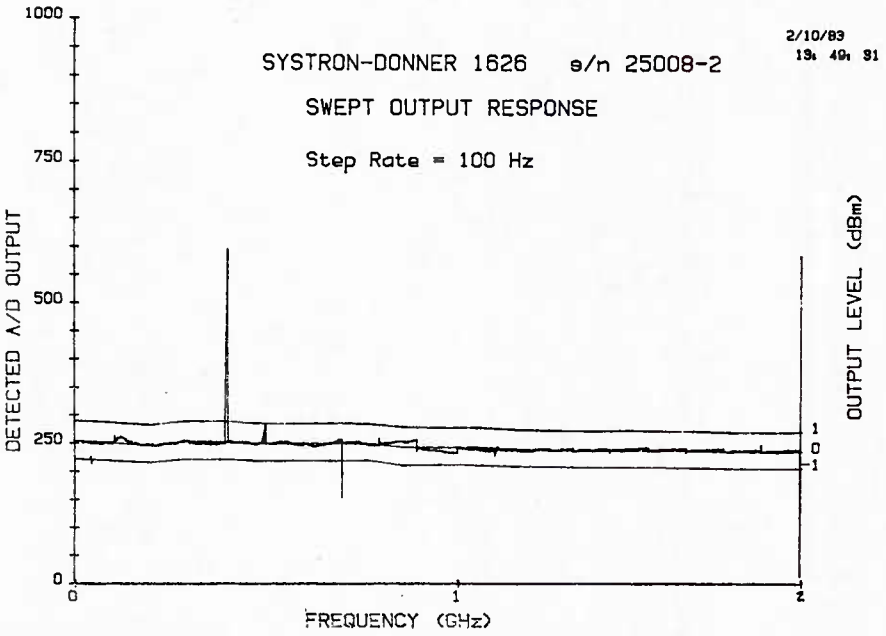
SWEEP OUTPUT TEST

Language: HPL Controller: HP-26/36

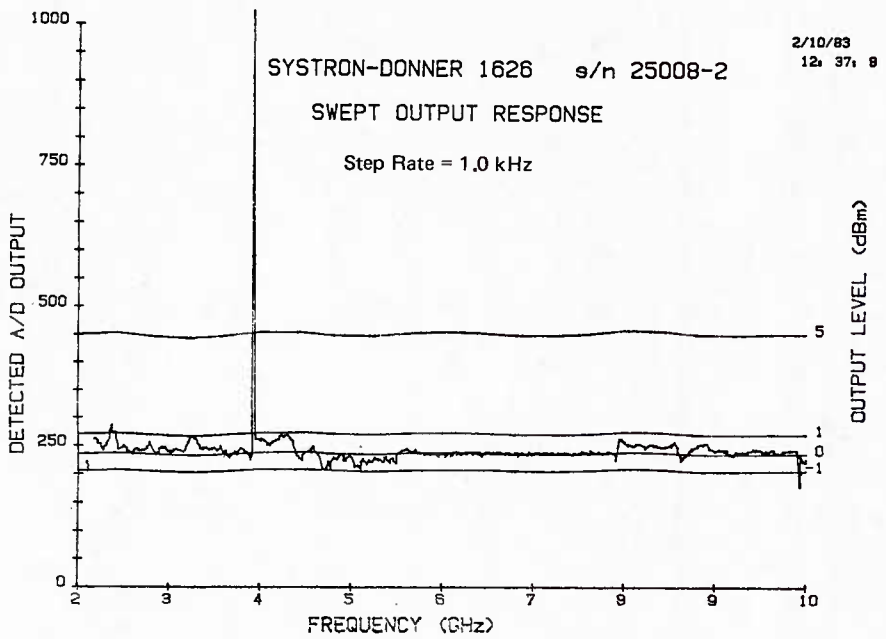
```
 0: "A/D CONVERSION of SWEEP OUTPUT - (sweepSD)":
 1:
 2: "Revision 4: JJO 1/18/83":
 3: dim L$[60],N$[15],D$[10],X$[80],U$[15],S$[30]
 4: "SYSTRON-DONNER 1626"}L$;aclr
 5: getk "sweepKEYS"
 6: gsb "B/D"
 7: ent "DRAW Hdcpy Diagram? [C]=No 1=Yes",Q;if flg13;0}Q
 8: if Q=1;psc 705;gsb "BDh"
 9: aclr ;gclr;gsb "INIT"
10: dsp "Press k3 INIT for Change / [C]=NOchange";beep;stp
11:
12: ent "SET Clock?  [C]=No 1=Yes",Q;if flg13;0}Q
13: if Q=1;cll 'CLOCK'
14: gon
15: ent "START Freq? (GHz)",r1,"STOP Freq? (GHz)",r2
16: dsp "Set 1dB/step Atten } 5 dB";beep;stp
17: ent "# Points? [C]=1000",N;if flg13;1000}N
18: dim A[0:1,N]
19: ent "DATA? [C]=Level 1=Ramp",D;if flg13;0}D
20: if D=0;beep;dsp "A/D Cable -} DETECTOR Out  [C]";stp
21: if D=1;beep;dsp "A/D Cable -} Sweep Out  [C]";stp
22: dsp "START Sweep & [C] at Same Time";stp
23: for J=1 to N
24: wrt 710,"H8AJ"
25: -ior(shf(rdb(710),-8),rdb(710))}A[D,J];dsp J,A[D,J]
26: if J>1;if abs(A[D,J])<abs(A[D,J-1]/10);pbeep 500,1
27: next J;if D=0;gto 19
28:
29: "PLOT":psc 16;gclr;aclr ;1000}X;csiz 1.2
30: scl -1,11,-100,1025;fxd 0;xax 0,10/(r2-r1),0,10;yax 0,50,
0,1000,5
31: for J=1 to N
32: if J>100:if A[1,J]>A[1,J-10];pen;gto 35
33: plt -A[1,J]*1000/100/X,A[0,J];dsp J,A[1,J],A[0,J]
34: next J
35: dsp J,A[1,J],A[1,J-1];abs(A[1,J-1])}X
36:
37: "X-Axis Freq":
38: for J=0 to 10 by 10/(r2-r1)
39: plt J-.2,-30,3;fxd 0;lbl r1+(r2-r1)J/10
40: next J
41: "Y-Axis Mks":
42: dsp "A/D Cable }} Det Out";stp
43: gsb "Pen"
44: ent "dB Label? [C]=Quit",Z;if flg13;gto 52
```

```
45: gsb "Amp"
46: for J=0 to 10 by .5
47: gsb "S/D"
48: wait 200;gsb "A/D"
49: plt J,B
50: next J;pen
51: plt 10,B,3;lbl Z;gto 44
52: gsb "Pen"
53: plt 10.8,300,3;csiz 2,1.5,8/11,90;lbl "OUTPUT LEVEL (dBm)
"
54:
55: scl 0,10,0,10
56: csiz 2,1.5,8/11,0;plt 3.5,.2,3;lbl "FREQUENCY (GHz)"
57: csiz 2.2,1.5,8/11,0;plt 3,9,3;lbl L$,"   ",N$
58: plt 3.5,8.3,3;lbl "SWEPT OUTPUT RESPONSE"
59: csiz 2,1.5,8/11,0;plt 3.5,7.5,3;lbl S$
60: csiz 1.3,1.5,8/11,0;plt 9,9.5,3;lbl D$
61: cll 'Read Time'
62: csiz 2,1.5,8/11,90;plt .2,3,3;lbl "DETECTED A/D OUTPUT "
63: psc 16;ent "[C]=HDCPY 1=PRT",C;if flg13;0}C;psc 705;gsb "
Pen"
64: csiz 1.5;gto 30
65:
66: "Write":sfg 1;psc 705;scl 0,10,0,10;gsb "DISP"
67: ent "X",U;ent "Y",V;plt U,V,3;ent "[C]=Repos 1=PRT",P;if
flg13;jmp 0
68: ent "Format? (1-8)",F,"Angle? 0=Hor 90=Vert",A
69: csiz F,1.5,8/11,A;ent "Label 80<Spaces",X$;plt U,V,3;lbl
X$
70: ent "[C]=CHG 1=Repeat 2=Cont 3=Quit",R;if flg13;0}R;gto "
DISP"
71: if R=1;plt U,V,3;lbl X$;plt 10,10,3;gto "DISP"
72: if R=2;lbl X$;jmp -2
73: if R=3;stp
74: "DISP":psc 16;gclr;scl 0,10,0,10
75: 1}r5}r7}r9;2}r6}r8
76: plt .5,8;csiz r5;fxd 2;lbl "X =",X,"     Y =",Y
77: plt .5,7.5;csiz r6;lbl "U =",U,"     V =",V
78: plt .5,4;csiz r8;lbl "L Size =",F,"   Angle =",A
79: plt .5,3.5;csiz 1;lbl "X$ Label:";plt 1.7,3.5
80: wrt 724,"tx",X$,char(3);pen
81: if flg1;cfg 1;ret
82: gto 67
83:
84: "A/D":wrt 710,"H8AJ"
85: -ior(shf(rdb(710),-8),rdb(710))}B
86: ret
87:
88: "B/D":psc 16;gclr;aclr
89: "BDh":scl 0,10,0,10;if Q=1;gsb "Pen"
90: plt .5,7,3;iplt 2,0,2;iplt 0,1.5;iplt -2,0;iplt 0,-1.5,-3
91: plt 4,7,3;iplt 1,0,2;iplt 0,1;iplt -1,0;iplt 0,-1,-3
92: plt 7,5.25,3;iplt 1.5,0,2;iplt 0,1;iplt -1.5,0;iplt 0,-1,
-3
93: plt 1.2,7.8,3;csiz 2;lbl "UUT"
94: plt 1,7.4,3;csiz 1;lbl "S/D-1626"
95: plt 2.5,7.5,3;iplt 1.5,0,2
96: plt 1.75,7,3;iplt 0,-1.5,2;iplt .5,0
```

```
97: plt 5,7.5,3;iplt .25,0,2;iplt 0,-1.5;iplt .5,0
98: plt 2.25,5.25,3;iplt 1,0,2;iplt 0,.5;iplt -1,0;iplt 0,-.5
99: plt 3.25,5.5,3;iplt 2.5,0,2
100: plt 6,5.75,3;iplt 1,0,2
101: plt 5.9,5.25,3;iplt 0,1,2
102: plt 2.6,7.55,3;csiz 1;lbl "SWEEP"
103: plt 2.7,7.35,3;csiz 1;lbl "OUT"
104: plt 3.7,7.55,3;lbl "IN"
105: plt 5.1,7.55,3;lbl "OUT"
106: plt 1.8,6.8,3;lbl "RF"
107: plt 1.8,6.6,3;lbl "OUT"
108: plt 2.5.55,3;lbl "IN"
109: plt 3.3,5.55,3;lbl "OUT"
110: plt 2,9,3;csiz 2;lbl "SWEEP OUTPUT TEST SET-UP"
111: plt 4.3,7.6,3;csiz 1.3;lbl "POT"
112: plt 4.1,7.25,3;csiz 1.2;lbl "SET 0.9"
113: plt 2.6,5.4,3;lbl "DET"
114: plt 7.5,5.8,3;lbl "A/D"
115: plt 7.3,5.5,3;lbl "CONVERTER"
116: plt 6.3,5.8,3;lbl "Ch 4"
117: plt 1,4,3;csiz 2;lbl "First make RF OUTPUT run then SWEE
P OUT run"
118: plt 1,3.5,3;lbl "Use enough data points to cover time of
 sweep"
119: psc 16;ret
120:
121: "S/D":if J=0;wrt M,"01N0"
122: fmt 1,"H",fz3.0
123: wrt M+.1,10(r1+(r2-r1)J/10);ret
124: "Amp":fmt 9,"L",f1.0;wrt M+.9,5-Z;ret
125:
126: "INIT":
127: "--- UUT Address":725}M
128: "--- UUT s/n":"s/n 24011-2"}N$
129: "--- UUT Sweep Funtion":""}U$
130: "--- UUT Step Size":"Step Rate = 1.0 KHz"}S$
131: "--- Date":"1/18/83"}D$
132: wrt 16,D$,"     UUT is ",N$
133: wrt 16
134: wrt 16,U$,"     ",S$
135: ret
136: "CLOCK":
137: "Set Time":
138: ent "Time? (hhmm.ss)",p1
139: int(p1/100)}p2;int(p1-100p2)}p3;100frc(p1)}p4
140: stime p4+p3*60+p2*60^2
141: ret
142: "Read Time":
143: rtime}p1
144: int(p1/3600)}p2;p1-p2*60^2}p3
145: int(p3/60)}p4;p3-60*p4}p5
146: fxd 0;plt 9,9.2,3;csiz 1.3;lbl p2,":",p4,":",p5
147: ret
148: "Pen":
149: ent "Pen # CHANGE?  0=NoPEN (1-4)  [C]=#1",P;if flg13;1}
P
150: pen# P;ret
```

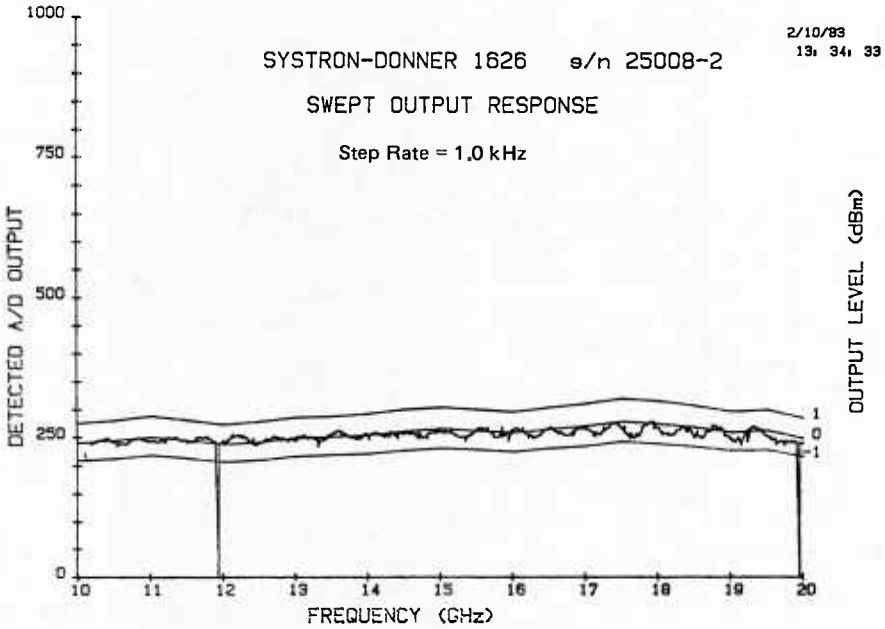


(a) Step rate — 100 Hz

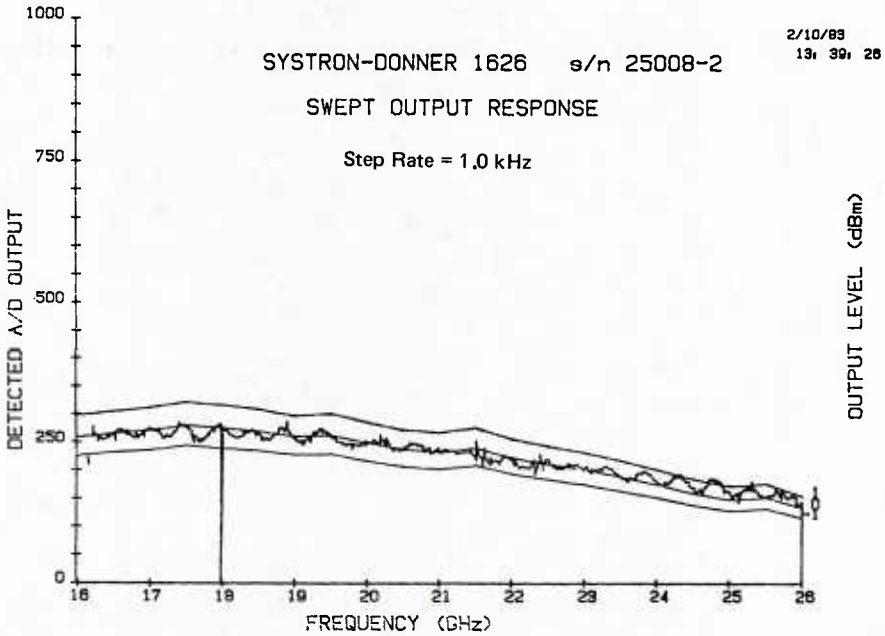


(b) Step rate — 1.0 kHz

Fig. H2 — Swept output response; Systron-Donner 1626 s/n 25008-2



(c) Step rate — 1.0 kHz



(d) Step rate — 1.0 kHz

Fig. H2 — Swept output response; Systron-Donner 1626 s/n 25008-2

Appendix I

CENTER FREQUENCY PULLING TEST

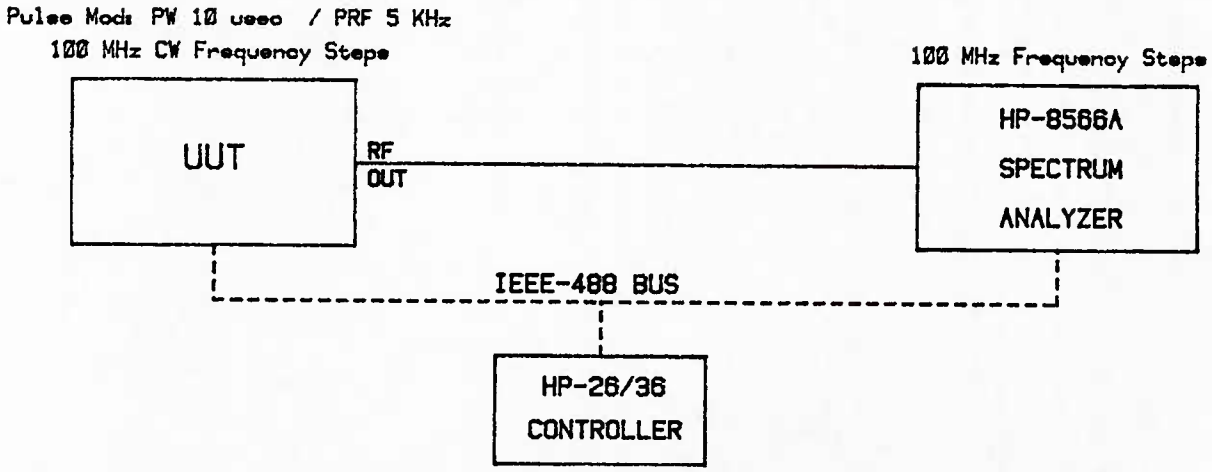


Fig. I1 — Carrier frequency pulling test; caused by pulse modulation

CENTER FREQUENCY PULLING TEST

Language: HPL Controller: HP-26/36

```
0: "FREQUENCY PULL TEST - [pullGT]":
1: "Author: JJO   11/1/82   Revision 2":
2: " Program steps G/T 1026 Sig Gen in 100 MHz":
3: "steps; modulates with 10 usec pulse at a ":
4: "10 KHz PRF.  8566 is tuned to center freq":
5: "displacement of peak under modulation is ":
6: "measured and recorded.":
7:
8: "8566A":dev "sa",718
9: "UUT":dev "uut",725
10: "2673A":dev "lp",701;701}P
11: dim H$[50],X$[30],Y$[30]
12:
13: ent "START Freq? (GHz)  [C]=.1",r1;if flg13;.1}r1
14: ent "STOP Freq? (GHz)  [C]=23.6",r2;if flg13;23.6}r2
15: ent "# STEPS?  [C]=235",r3;if flg13;235}r3
16: dim F[r3+1],C[r3+1],E[r3+1]
17: dim L$[96],K$[80];buf "L",L$,3;aclr ;gclr
18: dim R$[1,80],E$[20],S$[25],T$[30],D$[10],N$[10]
19:
20: dsp "Set PW } 10usec; PRF } 5k / [C]";pbeep 500,1;stp
21: ent "Date? mo/day",D$;D$&"/83"}D$
22: ent "UUT serial number? xxxxxx",N$
23: ent "PRINTER? [C]=Internal 1=2673A",P;if flg13;16}P
24: if P=1;701}P
25: fmt ;fxd 2
26:
27: oni 7,"*INTERRUPT";eir 7
28: gsb "HEADING"
29: cli 7;clr "sa";wrt "sa","TS"
30: wrt "sa","IP"
31:
```

```
32: for I=0 to r3
33: r1+(r2-r1)I/r3}C[I+1]
34: "UUT Freq":fmt 1,"GENFIXED MODPULSE FA",f5.0;wrt "uut.1",
1000C[I+1]
35: "UUT Amp":wrt "uut","LEVEL 0"
36: "UUT Mod":fmt 2,"MODRATEVAR PWIDTHVAR";wrt "uut.2"
37: fxd 3;dsp "F =",C[I+1]," GHz";wait 500
38: wrt "sa","CF",1000C[I+1],"MZ"
39: wrt "sa","SP.5MZ"
40: if I=0;wait 1000
41: wrt "sa","A2 S1"
42: wait 1000
43: wrt 718,"M2 TS"
44: wait 200
45: wrt "sa","M3 TS"
46: wait 200
47: wrt "sa","E1 TS"
48: wait 1000
49: '*MF'}F[I+1]
50: F[I+1]/1000C[I+1]/1e6}E[I+1]}X
51: fmt 3,f7.3,5x,e10.2,5x,e10.2
52: wrt 16.3,C[I+1],F[I+1],X
53: if P#16;if abs(X)>1e-6 and abs(F[I+1])>3e4;wrt P+.3,C[I+1
],F[I+1],X
54: if abs(X)>1e-6 and abs(F[I+1])>3e4;N+1}N
55: wrt "sa","M1 A1 S1"
56: next I
57: wrt "sa","IP"
58: for I=0 to r3
59: if E[I+1]>0 and E[I+1]>r4;E[I+1]}r4;C[I+1]}r5
60: if E[I+1]<0 and abs(E[I+1])>Y;abs(E[I+1])}Y;E[I+1]}r6;C[I
+1]}r7
61: next I
62: fmt 9,/,"Max +Offset ",e10.2," at ",f7.3
63: fmt 8,"Max -Offset ",e10.2," at ",f7.3
64: fmt 7,"No. Freqs over Spec ",f5.0
65: wrt P+.9,r4,r5;wrt P+.8,r6,r7;wrt P+.7,N
66: pbeep 200,1;dsp "FINISHED";stp
67: "/////////////// Subroutines ///////////////":
68: "HEADING":
69: wrt P," MODULATION FREQUENCY PULL TEST      ",D$
70: wrt P,"      GIGA-TRONICS 1026   s/n ",N$
71: wrt P,"-----------------------------------------"
72: wrt P," Freq (GHz)   delF (Hz)       delF/F"
73: wrt P,"-----------------------------------------"
74: ret
75:
```

```
"*************** Subprograms **************":
"*INTERRUPT":
if not bit(6,rds("sa")}R);gto +5
if bit(1,R);gto +4
if bit(3,R);prt "HARDWARE BROKEN!";gto +2
if bit(5,R);prt "ILLEGAL COMMAND!"
stp ;eir 7;iret
eir 7;iret
"END *INTERRUPT":

"*MA/*MF":
"EXT's: dev'sa'; E$; S$; *ERR; *SAVE":

"*MA":"03MA"}S$;"*MA"}E$;gto +3

"*MF":"03MF"}S$;"*MF"}E$;if p1=4;jmp 8
if not p0;3}p1;gto +3
if p0>1 or p1<1 or p1>4;jmp 9
char(48+p1)}S$[2,2]
cll '*SAVE';if ('.nL$'(63)}p0)=0;2}p3;jmp 7
wtb "sa",S$;if p1=1 or p1=3;red "sa",p2;jmp 2
rdb("sa")}p2;if p1=2;rot(p2,8)+rdb("sa")}p2
if p1=3 or p0#19;jmp 3
if p1=4;3}p3;jmp 3
if p2>1024;p2-4096}p2
ret p2
cll '*ERR'(p3);ret 0
"END *MA/*MF":

"*ERR":
fxd 0;spc 1;aclr ;gclr;wrt 16,"error",E$&str(-max(p1,1))
stp ;ret
"END *ERR":

"*SAVE/*RECALL":
"*SAVE":
if p0;"*SAVE"}E$;cll '*ERR';ret
rem "sa";buf "L";wtb "sa","OL";tfr "sa","L",80
jmp rds("L")=80
rem "sa";if '.nL$'(80)#162;1}p0;jmp -3
ret
"*RECALL":
if not p0;if  .nL$'(1)=31;if  '.nL$'(80)=162;gto +2
"*RECALL"}E$;cll '*ERR';ret
rem "sa";wtb "sa",L$,"HD"
ret

".nL$":ret shf(num(L$[p1,p1]),p2)
"END *SAVE/*RECALL":
"END OF PROGRAM":
```

MODULATION FREQUENCY PULL TEST 4/18/83
GIGA-TRONICS 1026 s/n 281902

Freq (GHz)	delF (Hz)	delF/F
17.100	-3.01E 04	-1.75E-06
20.900	-3.08E 04	-1.47E-06
21.300	-4.76E 04	-2.23E-06
23.000	-3.67E 04	-1.60E-06

Max +Offset 6.00E-05 at 0.100
Max -Offset -2.63E-05 at 0.400
No. Freqs over Spec 4

MODULATION FREQUENCY PULL TEST 4/18/83
GIGA-TRONICS 1026 s/n 281906

Freq (GHz)	delF (Hz)	delF/F

Max +Offset 1.71E-06 at 7.900
Max -Offset -9.50E-05 at 0.100
No. Freqs over Spec 0

Fig I2 — Sample data sheet

Appendix J

POWER METER ACCURACY

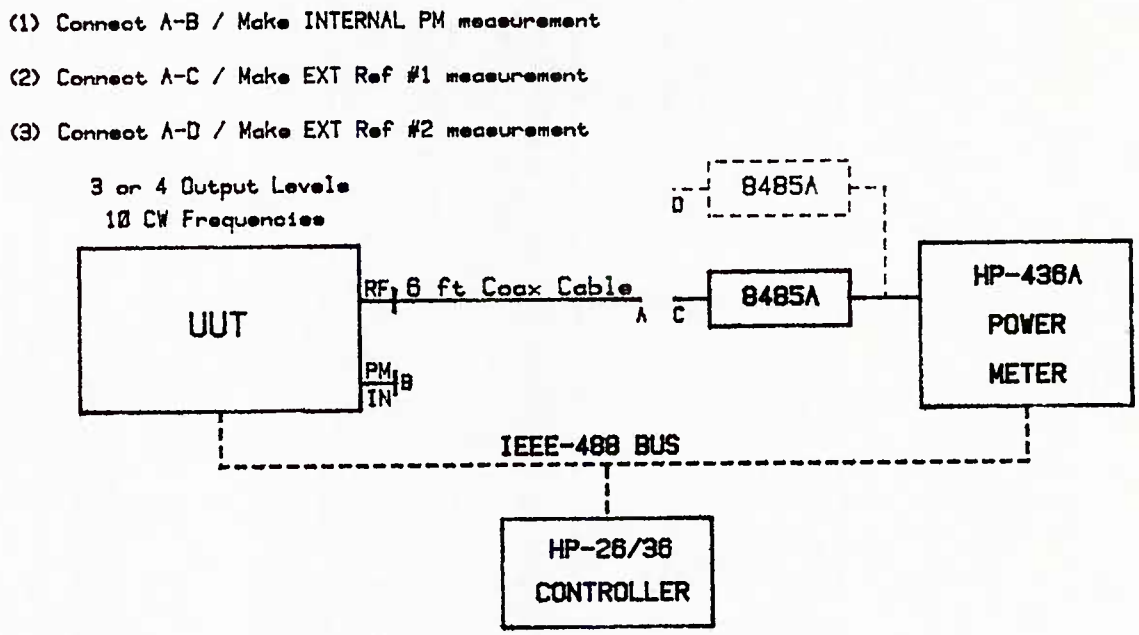


Fig. J1 — Power meter accuracy test

POWER METER ACCURACY TEST

Language: HPL Controller: HP-26/36

```
0: "EXT POWER METER ACCURACY TEST - (PMaccGT)":
1: "Use 436A Power Meter; 8485 Heads 648 & 163; low loss Gore
 cable":
2: "GT-1026 is signal source and UUT":
3:
4: dim A[100],B[100],F[100],T$[30],C$[80],N[100],K$[130,7],P$
[3,9],C[0:20]
5: dim M$[10],S$[15],D$[10],Y[30];"G/T 1026"}M$
6: aclr ;gclr
7: ent "Serial No?  xxxxxx",S$;"s/n "&S$}S$
8: ent "Date? mo/day",D$;D$&"/83"}D$
9: "436A"}P$[1];"436A"}P$[2];M$}P$[3];sfg 1
10: ent "START Freq? (GHz)",r1
11: ent "STOP Freq? (GHz)",r2
12: ent "Freq STEP Size? (GHz)",r3
13: ent "Output Level?  [C]=0 dBm",U;if flg13;0}U
14: r1}F;gsb "G/T"
15: gsb "LVL"
16: ent "PM? 0=436A/648 1=436A/163 2=UUT [C]=Print",Q;if flg1
3;gto "Print"
17: 0}I;dsp "Attach output to",P$[Q+1];beep;stp
18:
19: for F=r1 to r2 by r3
20: I+1}I;F}F[I]
21: gsb "G/T"
22: if Q=2;gsb "PWR"
23: if Q<=1;gsb "436A"
24: if Q=0;gsb "648"
25: if Q=1;gsb "163"
26: cll 'CF'(F,Y)
27: fmt 1,c4,f7.3,5x,c6,f6.2,c4
28: if Q=0;T/3+.047(100-Y)}A[I];wrt 16.1,"F = ",F,"648 = ",A[
I]," dBm"
29: if Q=1;T/3+.047(100-Y)}B[I];wrt 16.1,"F = ",F,"163 = ",B[
I]," dBm"
30: if Q=2;wrt 16.1,"F = ",F,"UUT = ",N[I]," dBm"
31: 0}T
32: next F;gsb "END"
33: gto 16
34: "Print":ent "PRINTER? [C]=Internal 1=2673A 2=7245B",P;if
flg13;16}P;aclr
35: if P=1;701}P
36: if P=2;706}P
37: fmt 9,c40,c15,5x,c8,/
38: if flg1;wrt P+.9,"G/T 1026 Ext Power Meter Accuracy Test"
,S$,D$
39: fmt 5,3x,"Generator Output =",f5.0," dBm";wrt P+.5,U
40: fmt 2,5x,"Freq",5x,"(1)G/T1026",4x,"(2)436/648",4x,"(3)43
6/163",z
41: fmt 6,4x,"(1)-(2)",4x,"(1)-(3)";wrt P+.2;wrt P+.6
42: fmt 3,5x,"(GHz)",4x,"Ampl (dBm)",4x,"Ampl (dBm)",4x,"Ampl
 (dBm)",z
43: fmt 7,5x,"  dB  ",5x,"  dB  ";wrt P+.3;wrt P+.7
```

```
44: fmt 4,f9.3,f11.2,f14.2,f14.2,f14.2,f11.2
45: for K=1 to I
46: wrt P+.4,F[K],N[K],A[K],B[K],N[K]-A[K],N[K]-B[K]
47: next K
48: ent "Type Comment  [C]=Return",C$
49: if flg13;ent "[C]=New Run  1=Print Again",R;if flg13;0}R}
I;cfg 1;gto 13
50: if R=1;0}R;gto "Print"
51: wrt P,"     ",C$;gto 48
52:
53: "8485":if F<1;100}Y
54: if F>=1;103.05-2.1232F+.41292FF-.037928F^3+.0015313F^4-F^
5*2.2814e-5}Y
55: "    ":gto "Retn"
56: "Retn":ret
57:
58: "G/T":if I=1;wrt 725,"GENFIXED MODOFF"
59: wait 100
60: fmt 1,"FA",f5.0
61: wrt 725.1,1000F
62: wait 200;ret
63: "LVL":wrt 725,"POWERINT"
64: fmt 2,"LEVEL",f5.1;wrt 725.2,U
65: wait 200;ret
66: "PWR":wrt 725,"POWEREXT SENDPOWER"
67: wait 500;red 725,N[I];wait 300;red 725,N[I]
68: ret
69:
70: "436A":for J=1 to 3
71: wrt 713,"A+V";fmt ;red 713,A;red 713,A
72: 10log(A/1e-3)}A;A+T}T
73: next J;ret
74:
75: "648":
76: data 100,99.7,98.8,99,98.6,97.9,97.8,97.6,97.4,97.1,97.1,
97.2,96.2,96
77: data 95.8,95.3,95,94.8,92.9,91.7,92.5,93.8,92.8,93.1,92.2
,91.6
78: for J=2 to 27;read Y[J];next J
79: rstr "648"
80: ret
81: "163":
82: data 100.1,99.2,99,99.3,98.8,98.4,97.9,97.8,97.6,97.5,97.
1,97.4,96.7
83: data 96.1,95.2,95.5,95,95.1,93.7,92.8,92.9,92.6,91.3,91.8
,88.3,85.2
84: for J=2 to 27;read Y[J];next J
85: rstr "163"
86: ret
87: "180":
88: data 99.2,98.6,98.8,98.5,98.2,97.9,97.6,97.2,97.3,97.2,96
.8,97.5,96.9
89: data 96.5,95.6,95.8,95.5,95.5,94.3,93.2,93.1,93.2,92.3,92
.4,88.6,83.4
90: for J=2 to 27;read Y[J];next J
91: rstr "180"
92: ret
93:
94: "CF":if p1<=2;100}p2;ret
```

```
95: for J=2 to 26
96: if p1>=J;J}p3;Y[J]}p4;Y[J+1]}p5
97: next J
98: p4+(p1-p3)(p5-p4)}p2
99: ret
100:
101: "END":for J=1 to 10
102: pbeep J100,.3\J
103: next J;ret
```

G/T 1026 Ext Power Meter Accuracy Test s/n 281906 4/21/83

Generator Output = 0 dBm

Freq (GHz)	(1)G/T1026 Ampl (dBm)	(2)436/648 Ampl (dBm)	(3)436/163 Ampl (dBm)	(1)-(2) dB	(1)-(3) dB
2.000	-0.20	-1.14	-1.14	0.94	0.94
4.000	-0.60	-1.48	-1.50	0.88	0.90
6.000	-1.20	-1.98	-1.99	0.78	0.79
8.000	-1.40	-2.17	-2.17	0.77	0.77
10.000	-1.80	-2.45	-2.46	0.65	0.66
12.000	-2.20	-2.75	-2.75	0.55	0.55
14.000	-2.70	-3.38	-3.40	0.68	0.70
16.000	-3.10	-3.57	-3.54	0.47	0.44
18.000	-3.30	-3.72	-3.71	0.42	0.41
20.000	-3.50	-4.00	-4.03	0.50	0.53
22.000	-3.40	-3.87	-3.88	0.47	0.48
24.000	-3.90	-4.09	-4.02	0.19	0.12
26.000	-4.40	-4.69	-4.51	0.29	0.11

6' Gore used

Generator Output = -15 dBm

Freq (GHz)	(1)G/T1026 Ampl (dBm)	(2)436/648 Ampl (dBm)	(3)436/163 Ampl (dBm)	(1)-(2) dB	(1)-(3) dB
2.000	-15.30	-15.65	-15.66	0.35	0.36
4.000	-15.30	-15.75	-15.74	0.45	0.44
6.000	-15.50	-16.13	-16.13	0.63	0.63
8.000	-15.70	-16.04	-16.06	0.34	0.36
10.000	-16.00	-16.18	-16.13	0.18	0.13
12.000	-16.00	-16.00	-16.01	-0.00	0.01
14.000	-16.40	-16.51	-16.53	0.11	0.13
16.000	-16.50	-16.68	-16.64	0.18	0.14
18.000	-16.60	-16.58	-16.56	-0.02	-0.04
20.000	-16.80	-16.91	-16.92	0.11	0.12
22.000	-16.30	-16.50	-16.49	0.20	0.19
24.000	-16.60	-16.60	-16.52	0.00	-0.08
26.000	-17.10	-16.78	-16.57	-0.32	-0.53

18 inch Gore coax used

Generator Output = -22 dBm

Freq (GHz)	(1)G/T1026 Ampl (dBm)	(2)436/648 Ampl (dBm)	(3)436/163 Ampl (dBm)	(1)-(2) dB	(1)-(3) dB
2.000	-22.90	-24.16	-24.33	1.26	1.43
4.000	-23.00	-24.04	-24.20	1.04	1.20
6.000	-23.00	-24.17	-24.33	1.17	1.33
8.000	-23.30	-24.69	-24.83	1.39	1.53
10.000	-23.50	-24.60	-24.77	1.10	1.27
12.000	-23.50	-24.35	-24.49	0.85	0.99
14.000	-24.00	-25.04	-25.30	1.04	1.30
16.000	-24.00	-25.23	-25.43	1.23	1.43
18.000	-24.30	-25.21	-25.44	0.91	1.14
20.000	-24.30	-25.56	-25.91	1.26	1.61
22.000	-23.90	-25.27	-25.59	1.37	1.69
24.000	-24.20	-25.32	-25.53	1.12	1.33
26.000	-24.90	-25.57	-25.70	0.67	0.80

Fig. J2 — Sample data sheet

Appendix K

INTERNAL PULSE WIDTH

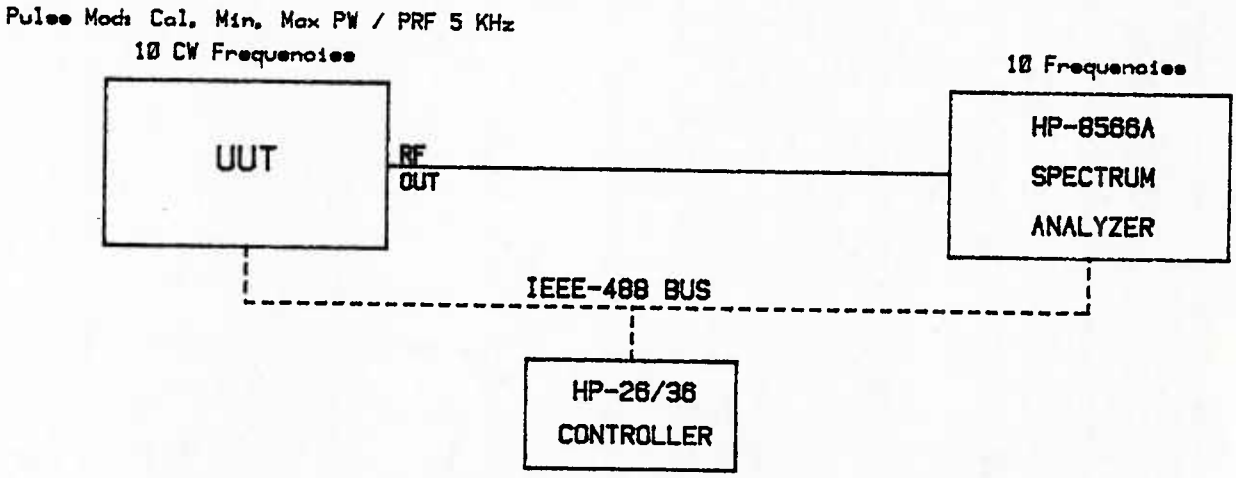


Fig. K1 — Internal pulse modulation test

INTERNAL PULSE WIDTH TEST

Language: HPL Controller: HP-26/36

```
0: "PULSE WIDTH (CAl/Max/Min) - [pwidthSD]":
1: "Author: JJO, 7/16/82; revised 2/9/83":
2: " Program sets SD-1626 Sig Gen to 10 freqs":
3: "measures Pulse Width for Cal, Min, and Max PULSE ":
4: "WIDTH settings":sfk
5:
6: "8566A":dev "sa",718
7: "2673A":dev "lp",701;701}P
8: dim H[2],H$[50],X$[30],Y$[30]
9: "UUT":dev "uut",724
10:
11: dim L$[96],K$[80];buf "L",L$,3;aclr ;gclr
12: dim R$[1,80],E$[20],S$[25],T$[30],D$[10],N$[10]
13: dim F[20],L[20,0:6],M[20,0:6];"PULSE MOD On/Off Ratio
    "}T$
14:
15: ent "Date? mo/day",D$;D$&"/83"}D$
16: ent "UUT serial number?",N$
17: beep;dsp "Set MOD Switch } INT PULSE / [C]";stp
18: "Printer":16}P
19: fmt ;fxd 2
20:
21: oni 7,"*INTERRUPT";eir 7
22:
23: cli 7;clr "sa";wrt "sa","TS"
24: .64}F[1];1.94}F[2];2.3}F[3]
25: 7.3}F[4];11.9}F[5];12.9}F[6]
26: 15}F[7];17.9}F[8];18.9}F[9];21.9}F[10]
27: aclr ;gsb "HEADING"
28:
29: for I=1 to 10
30: F[I]}C
31: "UUT Freq":fmt 1,"H",fz5.0;wrt "uut.1",1000C
32: "UUT Amp":wrt "uut","L0"
33: "UUT Sq Wave":wrt "uut","N101M0"
34: "Title":wrt "sa","KSE",T$&D$
35: fxd 3;dsp "F =",C," GHz"
36:
*12434
```

```
37: "START":if C<2;gsb "Lwide"
38: if C>=2;gsb "Hwide"
39: wait 1000
40: wrt "sa","CF",C,"GZ TS"
41: wrt "sa","SP5MZ TS"
42: wrt "sa","A2 TS"
43: wait 5000
44: wrt "sa","A3 B4 TS"
45: wrt "sa","M2 TS"
46: wrt "sa","M3"
47: wrt "sa","EK"
48: beep;dsp "Turn S/A KNOB: Move Mkr } 1st Envelope Null";st
p
49: rem "sa"
50: '*MF'}F;1e6/F}W
51: lcl "uut";fxd 3
52: pbeep 1000,1;dsp "On UUT: Set FREQ to ",C," MHz";stp
53: pbeep 100,.5;dsp "On UUT: Set MOD } Pulse; Width } MIN";s
tp
54: dsp "CAL Width =",W," usec"
55: wrt "sa","A1 M1"
56: wrt "sa","SP50MZ"
57: wrt "sa","A2 TS"
58: wait 5000
59: wrt "sa","A3 B4 TS"
60: wrt "sa","M2 TS"
61: wrt "sa","M3"
62: wrt "sa","EK"
63: beep;dsp "Turn S/A KNOB: Move Mkr } 1st Envelope Null";st
p
64: rem "sa"
65: '*MF'}F;1e6/F}N
66: pbeep 100,.5;dsp "On UUT: Set Width } MAX";stp
67: dsp "MIN Width =",N," usec"
68: wrt "sa","A1 M1"
69: wrt "sa","SP500KZ"
70: wrt "sa","A2 TS"
71: wait 5000
72: wrt "sa","A3 B4 TS"
73: wrt "sa","M2 TS"
74: wrt "sa","M3"
75: wrt "sa","EK"
76: beep;dsp "Turn S/A KNOB: Move Mkr } 1st Envelope Null";st
p
77: rem "sa"
78: '*MF'}F;1e6/F}M
79: gsb "PRINT"
80: next I
81: pbeep 200,1;dsp "FINISHED  [C] for Hardcopy";stp
82: adump "lp"
83: dsp "Hardcopy Completed";stp
84: "/////////////// Subroutines ///////////////":
85: "Lwide":wrt "sa","LF";ret
86: "Hwide":wrt "sa","IP";ret
87: "PRINT":
88: fmt 2,f7.3,3f12.3
89: wrt 16.2,C,W,M,N;ret
90: "HEADING":
91: wrt P,"     INT PULSE WIDTH CHECK TEST  ",D$
```

```
92: wrt P,"       SYSTRON-DONNER 1626   s/n ",N$
93: wrt P,"-------------------------------------------------"
94: wrt P,"   Freq      CAL Width    MAX Width    MIN Width"
95: wrt P,"   (GHz)       (usec)       (usec)       (usec)"
96: wrt P,"-------------------------------------------------"
97: ret
98: "*************** Subprograms **************":
99: "*INTERRUPT":
100: if not bit(6,rds("sa")}R);gto +5
101: if bit(1,R);gto +4
102: if bit(3,R);prt "HARDWARE BROKEN!";gto +2
103: if bit(5,R);prt "ILLEGAL COMMAND!"
104: stp ;eir 7;iret
105: eir 7;iret
106: "END *INTERRUPT":
107:
108: "*MA/*MF":
109: "EXT's: dev'sa'; E$; S$; *ERR; *SAVE":
110:
111: "*MA":"03MA"}S$;"*MA"}E$;gto +3
112:
113: "*MF":"03MF"}S$;"*MF"}E$;if p1=4;jmp 8
114: if not p0;3}p1;gto +3
115: if p0>1 or p1<1 or p1>4;jmp 9
116: char(48+p1)}S$[2,2]
117: cll '*SAVE';if ('.nL$'(63)}p0)=0;2}p3;jmp 7
118: wtb "sa",S$;if p1=1 or p1=3;red "sa",p2;jmp 2
119: rdb("sa")}p2;if p1=2;rot(p2,8)+rdb("sa")}p2
120: if p1=3 or p0#19;jmp 3
121: if p1=4;3}p3;jmp 3
122: if p2>1024;p2-4096}p2
123: ret p2
124: cll '*ERR'(p3);ret 0
125: "END *MA/*MF":
126: "*ERR":
127: fxd 0;spc 1;aclr ;gclr;wrt 16,"error",E$&str(-max(p1,1))
128: stp ;ret
129: "END *ERR":
130: "*SAVE/*RECALL":
131: "*SAVE":
132: if p0;"*SAVE"}E$;cll '*ERR';ret
133: rem "sa";buf "L";wtb "sa","0L";tfr "sa","L",80
134: jmp rds("L")=80
135: rem "sa";if '.nL$'(80)#162;1}p0;jmp -3
136: ret
137: "*RECALL":
138: if not p0;if '.nL$'(1)=31;if '.nL$'(80)=162;gto +2
139: "*RECALL"}E$;cll '*ERR';ret
140: rem "sa";wtb "sa",L$,"HD"
141: ret
142: ".nL$":ret shf(num(L$[p1,p1]),p2)
143: "END *SAVE/*RECALL":
144: "END OF PROGRAM":
*19855
```

INT PULSE WIDTH CHECK TEST 2/9/83
SYSTRON-DONNER 1626 s/n 25008-2

Freq (GHz)	CAL Width (usec)	MAX Width (usec)	MIN Width (usec)
0.640	0.985	9.901	0.056
1.940	0.966	9.479	0.055
2.300	0.966	9.479	0.055
7.300	0.957	9.804	0.054
11.900	0.930	9.852	0.055
12.900	0.930	10.010	0.045
15.000	0.939	10.215	0.045
17.900	0.935	9.662	0.045
18.900	0.930	9.930	0.055
21.900	0.917	10.288	0.052

INT PULSE WIDTH CHECK TEST 2/9/83
SYSTRON-DONNER 1626 s/n 25009-2

Freq (GHz)	CAL Width (usec)	MAX Width (usec)	MIN Width (usec)
0.640	0.952	9.950	0.058
1.940	0.957	9.852	0.055
2.300	0.943	9.852	0.053
7.300	0.962	9.852	0.052
11.900	0.976	10.256	0.051
12.900	0.962	10.428	0.040
15.000	1.036	9.786	0.040
17.900	1.005	10.152	0.040
18.900	0.943	9.881	0.052
21.900	0.957	9.833	0.051

Fig. K2 — Sample data sheet

Appendix L

EXTERNAL PULSE MODULATION TEST

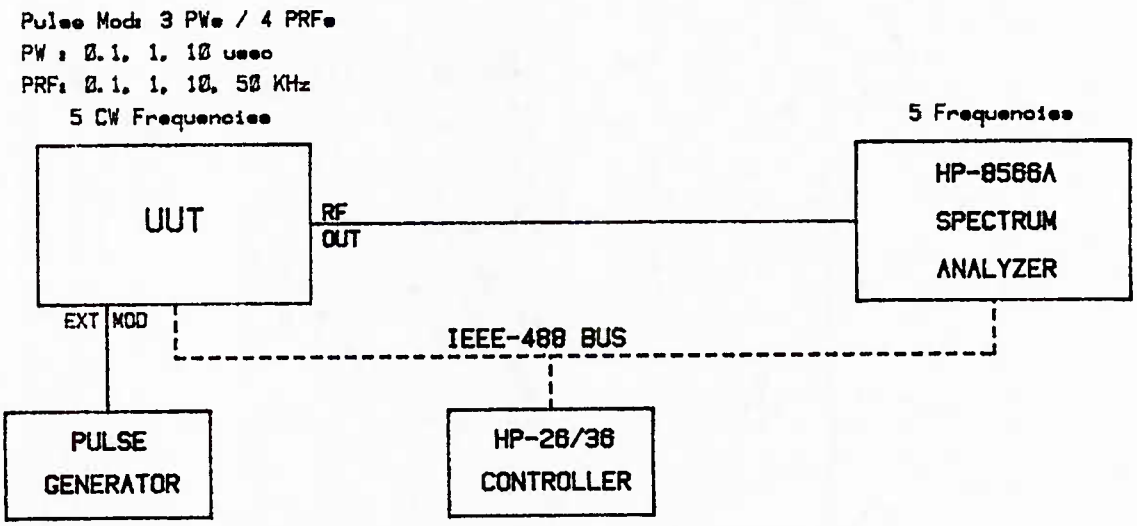


Fig. L1 — External pulse modulation test; operational verification

EXTERNAL PULSE MODULATION TEST

Language: HPL Controller: HP-26/36

```
0: "EXT PULSE WIDTH (CAl/Max/Min) - [XpwidthGT]":
1: "Author: JJO, 7/16/82; revise 1/17/83":
2: "Program EXTernally pulse modulates sig gen with":
3: "CAL/MAX/MIN pulse widths at 1KHz/100Hz/50KHz PRF":
4:
5: getk "pwidthKEYS"
6: "8566A":dev "sa",718
7: "2673A":dev "lp",701;701}P
8: "7470A":dev "gp",705;psc 16;dim H[2],H$[50],X$[30],Y$[30]
9: "UUT ADDRESS":ent "UUT Address? 7xx  [C]=25",A;700+A}A;if fl
g13;725}A
10: "UUT":dev "uut",A
11: "New PWidth Flag":sfg 1
12:
13: dim L$[96],K$[80],C$[80];buf "L",L$,3;aclr ;gclr
14: dim R$[1,80],E$[20],S$[25],T$[30],D$[10],N$[10]
15: dim F[20],L[20,0:6],M[20,0:6];"EXT Modulation Test
  "}T$
16:
17: ent "Date? mo/day",D$;D$&"/83"}D$
18: ent "UUT serial number? xxxxxx",N$
19: "Printer":16}P
20: fmt ;fxd 2
21:
22: oni 7,"*INTERRUPT";eir 7
23:
24: cli 7;clr "sa";llo 7;wrt "sa","TS"
25: 3}F[1];.593}F[2];6.108}F[3];14.726}F[4];20.982}F[5]
26: aclr
27:
28: for W=1 to 3
29: for K=1 to 4
30: for I=1 to 5
31: F[I]}C
32: "UUT Freq":fmt 1,"GENFIXED FA",f5.0;wrt "uut.1",1000C
33: "UUT Amp":wrt "uut","LEVEL0"
34: "UUT Ext Mod":wrt "uut","MODEXT-"
35: "Title":wrt "sa","KSE",T$&D$
36:
37: "START":
38: if K=1 and W=1;gsb "1"
39: if K=1 and W=2;gsb "1A"
40: if K=1 and W=3;gsb "1B"
41: if K=2;gsb "2"
42: if K=3;gsb "3"
43: if K=4;gsb "4"
44: wait 1000
```

```
45: wrt "sa","CF",C,"GZ TS"
46: if W=1;wrt "sa","SP5MZ TS"
47: if W=2;wrt "sa","SP100MZ TS"
48: if W=3;wrt "sa","SP.5MZ TS"
49: if flg1;dsp "[C] to Proceed with Test";beep;wait 300;beep;s
tp
50: if I=1 and flg1;wrt "sa","A1 A2 TS"
51: dsp "[C] for Next Freq";cfg 1;stp
52: wrt "sa","A3 B1"
53: next I
54: next K
55: sfg 1;next W
56: beep;stp
57: pbeep 200,1;dsp "FINISHED  [C] for Copy";stp
58: aclr ;gclr
59: wrt 16," EXTERNAL PULSE MODULATION CHECK      ",D$
60: wrt 16,""
61: wrt 16,"  GIGA-TRONICS 1026       s/n ",N$;wrt 16
62: ent "Comment?  [C]=Cks OK",C$;if flg13;wrt 16,"         ALL
CHECKS OK "
63: if flg13;jmp 2
64: wrt 16,C$;wrt 16;jmp -2
65: dsp "[C] for Hardcopy";stp
66: adump "lp"
67: dsp "Hardcopy Completed";stp
68: "/////////////// Subroutines ///////////////":
69: "Lwide":wrt "sa","LF";ret
70: "Hwide":wrt "sa","IP";ret
71:
72: "1":gclr;pbeep 500,1;scl 0,10,0,10;csiz 3
73: plt 0,9;lbl "Pulse Gen: Set NORMAL; PULSE; POS; COMPL"
74: plt 0,7;lbl "Pulse Gen: F=1KHz; A=4.0v"
75: csiz 5;plt 3,5;lbl "PW = 1usec"
76: csiz 4;fxd 3;plt 3,3;lbl "RF = ",C," GHz"
77: ret
78: "1A":gclr;pbeep 100,1;scl 0,10,0,10;csiz 3
79: plt 0,9;lbl "Pulse Gen: Set NORMAL; PULSE; POS; COMPL"
80: plt 0,7;lbl "Pulse Gen: F=1KHz; A=4.0v"
81: csiz 5;plt 3,5;lbl "PW = 100nsec"
82: csiz 4;fxd 3;plt 3,3;lbl "RF = ",C," GHz"
83: ret
84: "1B":gclr;pbeep 1000,1;scl 0,10,0,10;csiz 3
85: plt 0,9;lbl "Pulse Gen: Set NORMAL; PULSE; POS; COMPL"
86: plt 0,7;lbl "Pulse Gen: F=1KHz; A=4.0v"
87: csiz 5;plt 3,5;lbl "PW = 10usec"
88: csiz 4;fxd 3;plt 3,3;lbl "RF = ",C," GHz"
89: ret
90: "2":gclr;beep;scl 0,10,0,10;csiz 3
91: plt 0,8;lbl "Pulse Gen: Set NORMAL; PULSE; POS; COMPL"
92: csiz 5;plt 3,6;lbl "PRF = 100 Hz"
93: csiz 4;fxd 3;plt 3,3;lbl "RF = ",C," GHz"
94: ret
95: "3":gclr;beep;scl 0,10,0,10;csiz 3
96: plt 0,8;lbl "Pulse Gen: Set NORMAL; PULSE; POS; COMPL"
97: csiz 5;plt 3,6;lbl "PRF = 10 KHz"
98: csiz 4;fxd 3;plt 3,3;lbl "RF = ",C," GHz"
99: ret
```

```
100: "4":gclr;beep;scl 0,10,0,10;csiz 3
101: plt 0,8;lbl "Pulse Gen: Set NORMAL; PULSE; POS; COMPL"
102: csiz 5;plt 3,6;lbl "PRF = 50 KHz"
103: csiz 4;fxd 3;plt 3,3;lbl "RF = ",C," GHz"
104: ret
105: "*************** Subprograms **************":
106: "*INTERRUPT":
107: if not bit(6,rds("sa")}R);gto +5
108: if bit(1,R);gto +4
109: if bit(3,R);prt "HARDWARE BROKEN!";gto +2
110: if bit(5,R);prt "ILLEGAL COMMAND!"
111: stp ;eir 7;iret
112: eir 7;iret
113: "END *INTERRUPT":
114:
115: "*MA/*MF":
116: "EXT's: dev'sa'; E$; S$; *ERR; *SAVE":
117:
118: "*MA":"03MA"}S$;"*MA"}E$;gto +3
119:
120: "*MF":"03MF"}S$;"*MF"}E$;if p1=4;jmp 8
121: if not p0;3}p1;gto +3
122: if p0>1 or p1<1 or p1>4;jmp 9
123: char(48+p1)}S$[2,2]
124: cll '*SAVE';if ('.nL$'(63)}p0)=0;2}p3;jmp 7
125: wtb "sa",S$;if p1=1 or p1=3;red "sa",p2;jmp 2
126: rdb("sa")}p2;if p1=2;rot(p2,8)+rdb("sa")}p2
127: if p1=3 or p0#19;jmp 3
128: if p1=4;3}p3;jmp 3
129: if p2>1024;p2-4096}p2
130: ret p2
131: cll '*ERR'(p3);ret 0
132: "END *MA/*MF":
133: "*ERR":
134: fxd 0;spc 1;aclr ;gclr;wrt 16,"error",E$&str(-max(p1,1))
135: stp ;ret
136: "END *ERR":
137:
138: "*SAVE/*RECALL":
139: "*SAVE":
140: if p0;"*SAVE"}E$;cll '*ERR';ret
141: rem "sa";buf "L";wtb "sa","OL";tfr "sa","L",80
142: jmp rds("L")=80
143: rem "sa";if '.nL$'(80)#162;1}p0;jmp -3
144: ret
145: "*RECALL":
146: if not p0;if '.nL$'(1)=31;if  .nL$'(80)=162;gto +2
147: "*RECALL"}E$;cll '*ERR';ret
148: rem "sa";wtb "sa",L$,"HD"
149: ret
150: ".nL$":ret shf(num(L$[p1,p1]),p2)
151: "END *SAVE/*RECALL":
152: "END OF PROGRAM":
153: ent "Comment?  [C]=Cks OK",C$;if flg13;wrt 16,"        ALL
 CHECKS OK "
154: if flg13;jmp 2
155: wrt 16,C$;wrt 16;jmp -2
156: dsp "[C] for Hardcopy";stp
157: adump "lp"
```

EXTERNAL PULSE MODULATION CHECK 2/9/82

SYSTRON-DONNER 1626 s/n 25009-2

ALL CHECKS OK

EXTERNAL PULSE MODULATION CHECK 2/9/82

SYSTRON-DONNER 1626 s/n 25008-2

ALL CHECKS OK

Fig. L2 — Sample data sheet

Appendix M

EXTERNAL REFERENCE LOCK

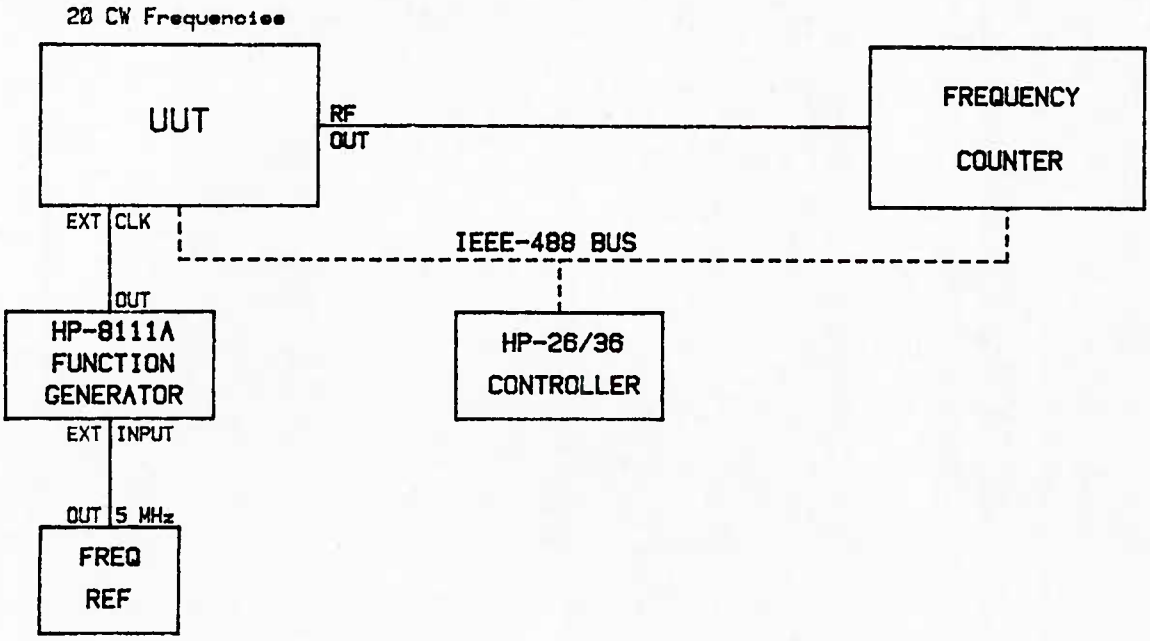


Fig. M1 — External reference lock test

EXTERNAL REFERENCE LOCK TEST

Language: HPL Controller: HP-26/36

```
0: "EXT REFERENCE OPERATION CHECK - [XrefSD]":
1: "Author: JJO. 7/23/82":
2: "Program applies Ext 1 MHz derived from external frequency s
td":
3: "to 1 MHz REF input of SD-1626 Sig Gen; Lock and Level check
ed":
4: "at 20 freqs":
5:
6: "8566A":dev "sa",718
7: "2673A":dev "lp",701;701}P
8: dim H[2],H$[50],X$[30],Y$[30]
9: "6054B":dev "ct",720
10: "UUT":dev "uut",725
11: dim L$[96],K$[80];buf "L",L$,3;aclr ;gclr
12: dim R$[1,80],E$[20],S$[25],T$[30],D$[10],N$[10]
13: dim F[20],L[20,0:6],M[20,0:6];"EXT REFERENCE CHECK
  "}T$
14:
15: gsb "BD"
16: dsp "[C] when ready";beep;stp
17: ent "Date? mo/day",D$;D$&"/82"}D$
18: ent "UUT serial number?",N$
19: "Printer":16}P
20: fmt ;fxd 2
21:
22: cli 7;llo 7
23: data .105,.321,.77,1.513,2.409,3.536,4.814,5.791,6.869,8.07
5,9.182
24: data 11.406,13.317,15.421,17.361,19.425,21.833,23.647,24.08
8,25.792
25: for J=1 to 20;read F[J];next J
26: aclr ;gclr
27: gsb "1"
28: stp
29: for I=1 to 20
30: F[I]}C;if I=1;aoff
31: "UUT Freq":fmt 1,"H",fz5.0;wrt "uut.1",1000C
32: "UUT Amp":wrt "uut","L0N0M001"
33:
34: "START":
35: if I=1;gsb "2"
36: if I=1;stp
37: wrt "ct","JGN";aon;goff
38: red "ct",A;dsp A
39: if I=1 and A-1e6#0;dsp "Adjust Pulse Freq";beep;stp
40: if I=1 and A-1e6#0;jmp -3
41: if I=1;aoff;gon
42: if I=1;gsb "3"
43: if I=1;stp
44: wrt "ct","HDN";red "ct",A;goff;aon
45: wrt "ct","HDN";red "ct",A
46: red "uut",B
```

```
47: if I=1;gsb "HEADING"
48: abs(C-A*1e-9)}E
49: if E>1e-6;fmt 2,"Error at ",f7.3," GHz of ",f8.3," KHz";wrt
 16.2,C,E*1e6
50: fmt 1,c13,f7.3," GHz"
51: if B=1 or B=3;wrt 16.1,"UNlock at    ",C
52: if B=2 or B=3;wrt 16.1,"UNlevel at   ",C
53: if B=0;wrt 16.1,"Status OK at ",C
54: next I
55: aon
56: pbeep 200,1;dsp "FINISHED  [C] for Hardcopy";stp
57: adump "lp"
58: dsp "Hardcopy Completed";stp
59: "/////////////// Subroutines ///////////////":
60: "Lwide":wrt "sa","LF";ret
61: "Hwide":wrt "sa","IP";ret
62: "1":gclr;pbeep 500,1;scl 0,10,0,10;csiz 3
63: plt 0,9;lbl "Pulse Gen: Set TRIGGER; SQ WAVE; POS; COMPL"
64: plt 0,7;lbl "Pulse Gen: A=1vp-p AMPL=-20dB"
65: csiz 5;plt 2,5;lbl "1MHz < F < 1.25MHZ"
66: csiz 3;plt 0,3;lbl "[C] when Ready"
67: ret
68: "2":gclr;pbeep 100,1;scl 0,10,0,10;csiz 3
69: plt 0,9;lbl "Connect Pulse Gen OUTPUT to ----------"
70: plt 0,7;lbl "20Hz-20MHz Counter Input"
71: plt 0,5;lbl "[C] when Ready"
72: ret
73: "3":gclr;pbeep 1000,1;scl 0,10,0,10;csiz 3
74: plt 0,9;lbl "Connect Pulse Gen OUTPUT to ------"
75: plt 0,7;lbl "1 MHz REF on UUT; Set INT/EXT to EXT"
76: plt 0,5;lbl "[C] when Ready"
77: ret
78: "HEADING":aclr
79: wrt 16,"  EXT REFERENCE CHECK       ",D$
80: wrt 16,"SYSTRON-DONNER 1626     s/n ",N$
81: wrt 16,"-----------------------------------"
82: ret
83: "BLOCK DIAGRAM":
84: "BD":psc 16;scl 0,10,0,10;csiz 2;gclr
85: plt 2,5,-2;iplt 1.5,0;iplt 0,1;iplt -1.5,0;iplt 0,-1,-3
86: plt 2.4,5.6,3;lbl "PULSE"
87: csiz 1.5;plt 2.3,5.2,3;lbl "GENERATOR"
88: plt 2.75,5,-2;iplt 0,-1.5,-3
89: plt 2,5.75,-2;iplt -.5,0;iplt 0,2;iplt .5,0,-3
90: csiz 1.5;plt 1.2,5.5,3;lbl "OUTPUT"
91: plt 1,7.9,3;lbl "1 MHz REF"
92: plt 2,7,-2;iplt 1.5,0;iplt 0,1;iplt -1.5,0;iplt 0,-1,-3
93: csiz 2;plt 2.4,7.65,3;lbl "1626"
94: csiz 1.5;plt 2.2,7.2,3;lbl "   UUT   "
95: plt 3.5,7.5,-2;iplt 1.5,0
96: csiz 1.2;plt 3.6,7.6,3;lbl "RF"
97: plt 5,7,-2;iplt 1.5,0;iplt 0,1;iplt -1.5,0;iplt 0,-1,-3
98: csiz 1.8;plt 5.3,7.4,3;lbl "COUNTER"
99: csiz 1.5;plt 2.8,3.6,3;lbl "5 MHz"
100: csiz 1.5;plt 2.8,4.6,3;lbl "EXT INPUT"
101: plt 2,2.5,-2;iplt 1.5,0;iplt 0,1;iplt -1.5,0;iplt 0,-1,-3
102: csiz 1.8;plt 2.3,3.15,3;lbl " FREQ  "
103: plt 2.15,2.7,3;lbl "REFERENCE"
104: csiz 3.5;plt 2,9,3;lbl "EXTERNAL REF CHECK"
105: ret
```

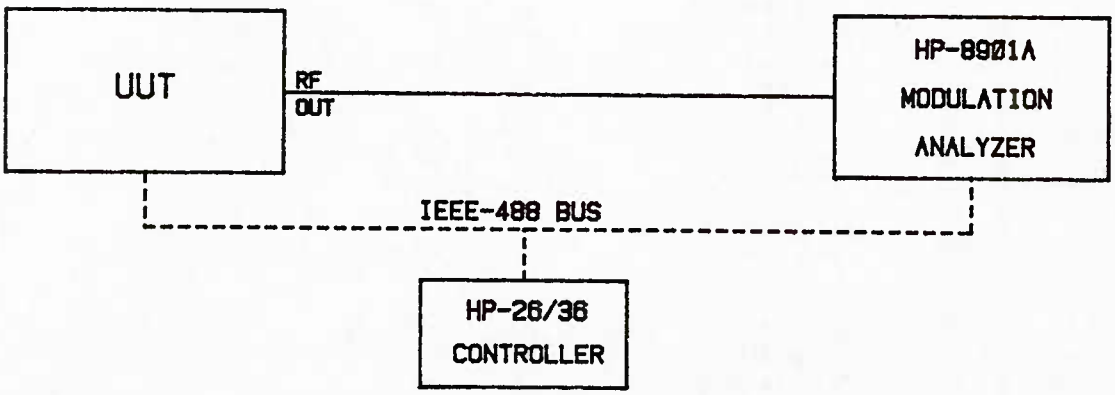
```
  EXT REFERENCE CHECK        2/9/82
SYSTRON-DONNER 1626      s/n 25008-2
-----------------------------------
Status OK at    0.105 GHz
Status OK at    0.321 GHz
Status OK at    0.770 GHz
Status OK at    1.513 GHz
Status OK at    2.409 GHz
Status OK at    3.536 GHz
Status OK at    4.814 GHz
Status OK at    5.791 GHz
Status OK at    6.869 GHz
Status OK at    8.075 GHz
Status OK at    9.182 GHz
Status OK at   11.406 GHz
Status OK at   13.317 GHz
Status OK at   15.421 GHz
Status OK at   17.361 GHz
Status OK at   19.425 GHz
Status OK at   21.833 GHz
Status OK at   23.647 GHz
Status OK at   24.088 GHz
Status OK at   25.792 GHz

  EXT REFERENCE CHECK        2/9/82
SYSTRON-DONNER 1626      s/n 25009-2
-----------------------------------
Status OK at    0.105 GHz
Status OK at    0.321 GHz
Status OK at    0.770 GHz
Status OK at    1.513 GHz
Status OK at    2.409 GHz
Status OK at    3.536 GHz
Status OK at    4.814 GHz
Status OK at    5.791 GHz
Status OK at    6.869 GHz
Status OK at    8.075 GHz
Status OK at    9.182 GHz
Status OK at   11.406 GHz
Status OK at   13.317 GHz
Status OK at   15.421 GHz
Status OK at   17.361 GHz
Status OK at   19.425 GHz
Status OK at   21.833 GHz
Status OK at   23.647 GHz
Status OK at   24.088 GHz
Status OK at   25.792 GHz
```

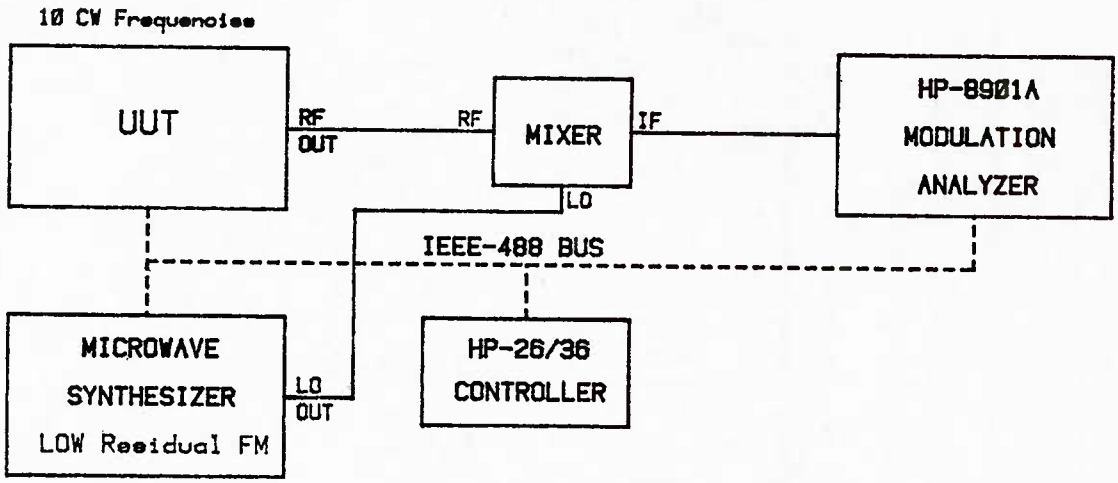
Fig. M2 — Sample data sheet

Appendix N

RESIDUAL FM TEST



(a) Frequency <1.2 GHz



(b) Frequency >1.2 GHz

Fig. N1 — Residual FM test

RESIDUAL FM TEST

Language: HPL Controller: HP-26/36

```
 0: "RESIDUAL FM MEASUREMENT - [residualFM]":
 1: "Author: JJO 1/81; revision 2 4/11/83":
 2:
 3: dim F[5];gclr;aclr ;psc 16;sfg 1
 4: dim A$[1],X$[80],Y$[80],T$[60],D$[10],S$[20]
 5: getk "FMkeys"
 6: gsb "BLOCK DIA"
 7: gsb "INIT"
 8: dsp "Press k3 INIT for Change / [C]=NOchange";beep;stp
 9: ent "Mixer? [C]=Yes 1=No",Z;if flg13;0}Z
10: if Z=0;ent "LO Source? [C]=8672 1=8340",S;if flg13;0}S
11: wrt M,"AU"
12: ent "CALIBRATE? [C]=No 1=Yes",Q;if flg13;0}Q
13: if Q=1;gsb "FM Cal"
14: "R":0}T;ent "UUT Output Freq? (GHz)  [C]=Quit",F;if flg13;g
to "END"
15: if Z=0;F+1}r0;if S=0;gsb "rf"
16: if S=1;gsb "rf1"
17: if S=0;cll 'amp'(10)
18: if S=1;cll 'amp1'(5)
19: wait 1000
20: wrt M,"C0AUM2L2H1D4"
21: aclr ;gclr;red M,A;red M,A
22: for J=1 to 10
23: red M,A;A+T}T
24: fmt 1,f3.0,f10.0,f10.0;wrt 16.1,J,A,T
25: next J
26: T/10}B;wrt 16;wrt 16.1,J-1," Ave FM = ",B," Hz"
27: ent "[C]=Print 1=Rerun",R;if flg13;0}R
28: if R=1;0}T;gto 21
29: if flg1;wrt P,T$,"  ",S$,"     ",D$
30: if flg1;cfg 1;wrt P
31: fmt 1,"Freq =",f6.0," MHz",3x,"FM =",f6.0," Hz ave =",f7.0,
" Hz pk =",z
32: fmt 2,f7.0," Hz p-p"
33: wrt P+.1,1000F,B,B*\2;wrt P+.2,B*2*\2
34: gto "R"
35: "FM Cal":dsp "**********FM CALIBRATION**********"
36: beep;dsp "Connect Cal OUT } INPUT";stp
37: dsp "Allow 30 minutes warm-up before CAL";stp
38: wrt M,"M2C1"
39: red M,C
40: fmt 9,"FM Cal-F=",f7.2
41: wrt P+.9,C
42: wrt M,"17.1SP"
43: aclr ;gclr
44: beep;dsp "Connect SIGNAL } INPUT";stp
45: ret
```

```
46: "BLOCK DIA":psc 16;gclr;aclr ;scl 0,10,0,10
47: plt 1,7,3;iplt 2,0,2;iplt 0,1.5;iplt -2,0;iplt 0,-1.5,-3
48: plt 1.3,3;iplt 2,0,2;iplt 0,1.5;iplt -2,0;iplt 0,-1.5,-3
49: plt 4,5.25,3;iplt 1,0,2;iplt 0,1;iplt -1,0;iplt 0,-1,-3
50: plt 7,5,3;iplt 2,0,2;iplt 0,1.5;iplt -2,0;iplt 0,-1.5,-3
51: plt 1.7,7.6,3;csiz 2;lbl "UUT"
52: plt 1.5,3.6,3;csiz 2;lbl "8672A"
53: plt 4.2,5.7,3;csiz 1.5;lbl "Mixer"
54: plt 7.2,5.9,3;csiz 1.5;lbl "   8901A  ";plt 7.3,5.45,3;lbl
"Mod Analyzer"
55: plt 3,7.75,3;iplt 1.5,0,2;iplt 0,-1.5
56: plt 3,3.75,3;iplt 1.5,0,2;iplt 0,1.5
57: plt 5,5.75,3;iplt 2,0,2
58: plt .2,1.7,3;lbl "F(o)-F(Lo)=F(b)"
59: plt 2,9,3;csiz 2;lbl "RESIDUAL FM TEST SET-UP"
60: plt 3.1,7.8,3;csiz 1;lbl "F(o)"
61: plt 3.1,3.8,3;lbl "F(Lo)"
62: plt 5.1,5.8,3;lbl "F(b)"
63: plt 6.5,5.8,3;lbl "F(b)"
64: ret
65: "rf":fmt 8,"P",fz9.6,"J0";wrt L+.8,r0;ret
66: "rf1":fmt 8,"CW",f10.6,"GZ";wrt L+.8,r0;ret
67: "amp":fmt 7,"K",2b
68: if p1>3;if p1<13;wrt L,"03";wrt L+.7,48,61-p1;ret
69: wrt L,"01"
70: int(abs(p1/10))}p2;wrt L+.7,p2+48,51-10p2-p1;ret
71: "amp1":fmt 7,"PL",f5.0,"DB"
72: wrt L+.7,p1;ret
73: "END":
74: if Z=0 and S=0;wrt 16,"LO = 8672A / Tuned 1 GHz above UUT"
75: if Z=0 and S=1;wrt 16,"LO = 8340A / Tuned 1 GHz above UUT"
76: if Z=1;wrt 16,"  No local osc; signal direct into 8901 Mod
Analyzer"
77: stp
78:
79: "INIT":aclr
80: "UUT Title":"RESIDUAL FM GIGA-TRONICS 1026"}T$
81: "Serial Number":"s/n 281902"}S$
82: "Date":"4/13/83"}D$
83: "UUT Address":725}G
84: "Mod Analyzer Address":714}M
85: "LO Address":719}L
86: "Printer Address":701}P
87: fxd 0;wrt 16,"1026 Address         ",G
88: wrt 16,"Mod Analyzer Address",M
89: wrt 16,"LO Address           ",L
90: wrt 16,"Printer Address      ",P
91: wrt 16
92: wrt 16,T$,"     ",S$,"     ",D$
93: wrt 16
94: ret
```

FM Cal-F= 100.08
RESIDUAL FM GIGA-TRONICS 1026 s/n 281902 4/25/83

Freq =	100	MHz	FM =	290	Hz	ave =	410	Hz	pk =	820	Hz p-p
Freq =	200	MHz	FM =	176	Hz	ave =	248	Hz	pk =	497	Hz p-p
Freq =	400	MHz	FM =	271	Hz	ave =	383	Hz	pk =	766	Hz p-p
Freq =	500	MHz	FM =	165	Hz	ave =	233	Hz	pk =	466	Hz p-p
Freq =	750	MHz	FM =	283	Hz	ave =	401	Hz	pk =	801	Hz p-p
Freq =	1000	MHz	FM =	280	Hz	ave =	396	Hz	pk =	791	Hz p-p
Freq =	1200	MHz	FM =	239	Hz	ave =	337	Hz	pk =	675	Hz p-p
Freq =	5000	MHz	FM =	159	Hz	ave =	224	Hz	pk =	448	Hz p-p
Freq =	7500	MHz	FM =	168	Hz	ave =	237	Hz	pk =	474	Hz p-p
Freq =	10000	MHz	FM =	334	Hz	ave =	472	Hz	pk =	943	Hz p-p
Freq =	10500	MHz	FM =	288	Hz	ave =	407	Hz	pk =	813	Hz p-p

RESIDUAL FM GIGA-TRONICS 1026 s/n 281906 4/25/83

Freq =	100	MHz	FM =	266	Hz	ave =	376	Hz	pk =	753	Hz p-p
Freq =	200	MHz	FM =	163	Hz	ave =	230	Hz	pk =	460	Hz p-p
Freq =	400	MHz	FM =	278	Hz	ave =	393	Hz	pk =	787	Hz p-p
Freq =	500	MHz	FM =	169	Hz	ave =	239	Hz	pk =	479	Hz p-p
Freq =	750	MHz	FM =	306	Hz	ave =	432	Hz	pk =	864	Hz p-p
Freq =	1000	MHz	FM =	299	Hz	ave =	422	Hz	pk =	845	Hz p-p
Freq =	1200	MHz	FM =	268	Hz	ave =	379	Hz	pk =	759	Hz p-p
Freq =	5000	MHz	FM =	125	Hz	ave =	177	Hz	pk =	353	Hz p-p
Freq =	7500	MHz	FM =	141	Hz	ave =	200	Hz	pk =	399	Hz p-p
Freq =	10000	MHz	FM =	250	Hz	ave =	354	Hz	pk =	708	Hz p-p
Freq =	10500	MHz	FM =	203	Hz	ave =	288	Hz	pk =	575	Hz p-p

Fig. N2 — Sample data sheet

Appendix O

FREQUENCY COUNTER OPERATION

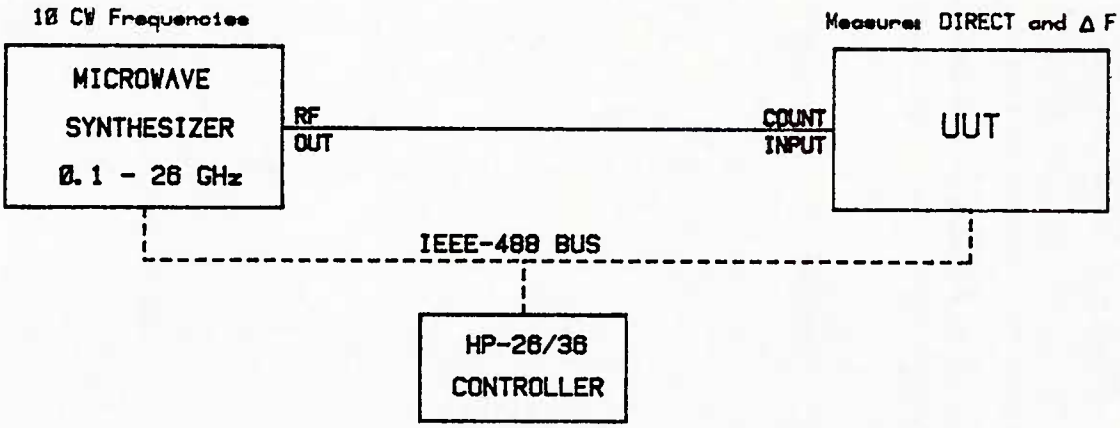


Fig. O1 — Frequency counter operation test

FREQUENCY COUNTER OPERATION TEST

Language: HPL Controller: HP-26/36

```
 0: "COUNTER OPERATION CHECK - (countGT)":
 1: "Composed: JJO 1/20/83":
 2:
 3: dim L$[60],N$[15],D$[10],X$[80],F[20],F$[30]
 4: "GIGA-TRONICS 1026"}L$;aclr ;gclr;sfg 1,2,3
 5: getk "countKEYS"
 6: gsb "B/D"
 7: dsp "[C] when ready";stp
 8: aclr ;gclr;gsb "INIT"
 9: dsp "Press k3 INIT for Change / [C]=NOchange";beep;stp
10: "R":ent "Counter FUNCTION? [C]=MeasDIRECT 1=MeasDEL-F",C;if
 flg13;0}C
11: if C=0;ent "Search WINDOW? (GHz)  [C]=5",D;if flg13;5}D
12: if C=0;D}W
13: if C=1;ent "DEL Offset? (+/-MHz) <500",D;D/1000}W
14: "TEST FREQS":rstr ;data .153,1.759,2.623,4.896,8.822,11.629
,13.774
15: data 15.365,18.181,20.743,22.961,25.783
16: for J=1 to 12;read F[J];next J
17: ent "Enter FREQs? [C]=No 1=Yes",Q;if flg13;0}Q;12}N
18: if Q=1;gsb "ENTER"
19:
20: for J=1 to N
21: gsb "S/Freq"
22: sfg 2;500}H;gsb "Count"
23: gsb "Read"
24: if C=0;0}T;D}W;gsb "PRINTOUT"
25: if C=1;0}T;D/1000}W;gsb "PRINTOUT-"
26: "N":next J
27: pbeep 500,1;dsp "FINISHED / [C] for Hardcopy";stp
28: adump "lp"
29: end
30: "B/D":psc 16;gclr;aclr
31: "BDh":scl 0,10,0,10
32: plt 1,6,3;iplt 2,0,2;iplt 0,1.5;iplt -2,0;iplt 0,-1.5,-3
33: plt 6,6,3;iplt 2,0,2;iplt 0,1.5;iplt -2,0;iplt 0,-1.5,-3
34: plt 1.6,7,3;csiz 2;lbl "GT-1026"
35: plt 1.6,6.4,3;csiz 2;lbl "Source"
36: plt 6.8,7,3;csiz 2;lbl "UUT"
37: plt 6.5,6.4,3;csiz 2;lbl "Counter"
38: plt 3,6.75,3;iplt 3,0,2
39: csiz 1.5;plt 3.1,6.85,3;lbl "RF"
40: plt 3.1,6.5,3;lbl "OUT"
41: plt 5.5,6.85,3;lbl "MEAS"
42: plt 5.7,6.5,3;lbl "IN"
43: psc 16;ret
```

```
44: "--------------- Subroutines ---------------":
45:
46: "S/Freq":wrt "s","GENFIXED MODOFF"
47: fmt 9,"LEVEL",f5.1;wrt "s.9",A
48: fmt 1,"FA",f5.0
49: wrt "s.1",1000F[J]
50: ret
51:
52: "Count":
53: fmt 2,"FA",f5.0
54: if F[J]<W+1 and C=0;100}r1
55: if F[J]>=W+1 and C=0;1000(F[J]-W)}r1
56: if C=0;wrt "uut.2",r1
57: fmt 3,"FB",f5.0
58: if F[J]<=26-W and C=0;1000(F[J]+W)}r2
59: if F[J]>26-W and C=0;26000}r2
60: if C=0;wrt "uut.3",r2
61: if C=1;wrt "uut.2",1000(F[J]-W)
62: if C=0;fmt 9,c1,f6.0,c4,f6.0,c4,f6.0,c2,5x,f3.0,f5.0,f7.2
63: if C=1;fmt 9,f9.3,f12.3,5x,f3.0,f5.0,f7.2
64: if C=0;wrt .9,"I",r1," <--",1000F[J]," -->",r2," I",T
65: if C=1;wrt .9,F[J],W,T
66: ret
67:
68: "Read":
69: if C=0;wrt .9,"I",r1," <--",1000F[J]," -->",r2," I",T,H,W
70: if C=1;wrt .9,F[J],W,T,H,W
71: if C=0;wrt "uut","MEASDIR SENDFREQ"
72: if C=1;wrt "uut","MEASDEL SENDFREQ"
73: wait H;if T=20;gsb "WAIT"
74: if T=50;gsb "SPAN"
75: if T=100;gto "SKIP"
76: red "uut",F$;1+T}T;if F$[7,8]="--";pbeep 600,.01;gto "Read"
77: val(F$[7,15])}F;pbeep 300,2;0}T
78: ret
79:
80: "INIT":
81: "--- UUT (Counter) Address":dev "uut",725
82: "--- Source 1026 Address":dev "s",724
83: "--- Source Level (dBm)":0}A
84: "--- UUT s/n":"s/n 271606"}N$
85: "--- PRINTER Address":dev "lp",701
86: "--- Date":"1/21/83"}D$
87: wrt 16,D$,"   UUT Counter is ",N$
88: wrt 16
89: fmt 1,c20,c12,f3.0
90: wrt 16.1,"Source Address ","724 / Level ",A
91: ret
92:
```

```
93: "PRINTOUT";
94: fmt 5,"   Direct COUNTER OPERATION CHECK",c12
95: fmt 4,"     GIGA-TRONICS 1026",c15
96: fmt 6,"   Input Freq    Meas Freq    Freq Diff"
97: fmt 7,"     (GHz)         (GHz)        (MHz)"
98: if flg1;aclr ;wrt 16.5,D$;wrt 16.4,N$;wrt 16.6;wrt 16.7;cfg
 1
99: fmt 8,f10.3,2x,f13.6,2x,f10.3
100: wrt 16.8,F[J],F/1000,1000F[J]-F
101: ret
102:
103: "PRINTOUT-":
104: fmt 5,"   del-F COUNTER OPERATION CHECK",c12
105: fmt 4,"GIGA-TRONICS 1026",c15," Offset = ",f4.0," MHz"
106: fmt 6,"   Input Freq    DEL Freq    Freq Diff"
107: fmt 7,"     (GHz)         (MHz)       (MHz)"
108: if flg1;aclr ;wrt 16.5,D$;wrt 16.4,N$,1000W;wrt 16.6;wrt 1
6.7;cfg 1
109: fmt 8,f10.3,2x,f12.3,2x,f10.3
110: wrt 16.8,F[J],F,D-F
111: ret
112:
113: "ENTER":
114: 1+I}I;ent "Freq? (GHz)  [C]=Quit",F[I];if flg13;aclr ;I-1}
N;ret
115: fmt 6,f3.0,2x,f8.3,c4;wrt 16.6,I,F[I],"GHz";jmp -1
116:
117: "SKIP":
118: for I=5 to 10;pbeep 100I,.1;next I
119: fmt 9,f10.3,c35
120: wrt 16.9,F[J],"Counter DOES NOT FIND Frequency"
121: if C=0;D}W;0}T;sfg 2,3;gto "N"
122: if C=1;D/1000}W;0}T;sfg 2,3;gto "N"
123:
124: "WAIT":
125: "Shortens wait time to .2 sec in 'Read' subroutine":
126: if flg2;cfg 2;0}T;.2H}H
127: ret
128:
129: "SPAN":
130: "Narrows search span to 1/10 that selected":
131: if flg3;cfg 3;W/10}W;J-1}J;0}T;gto "N"
132: ret
```

Direct COUNTER OPERATION CHECK 4/25/83
GIGA-TRONICS 1026 s/n 281902

Input Freq (GHz)	Meas Freq (GHz)	Freq Diff (MHz)
0.153	0.152989	0.011
1.759	1.759000	0.000
2.623	5.246002	-2623.002
4.896	8.230901	-3334.901
8.822	8.822003	-0.003
11.629	11.629005	-0.005
13.774	13.774006	-0.006
15.365	15.365006	-0.006
18.181	18.181008	-0.008
20.743	20.743009	-0.009
22.961	22.961010	-0.010
25.783	25.783011	-0.011
0.153	0.152938	0.062
1.759	1.759000	0.000
2.623	2.623001	-0.001
4.896	4.896002	-0.002
8.822	8.822003	-0.003
11.629	11.629005	-0.005
13.774	13.774006	-0.006
15.365	15.365006	-0.006
18.181	18.181008	-0.008
20.743	20.743009	-0.009
22.961	22.961010	-0.010
25.783	25.783011	-0.011

del-F COUNTER OPERATION CHECK 4/25/83
GIGA-TRONICS 1026 s/n 281902 Offset = -200 MHz

Input Freq (GHz)	DEL Freq (MHz)	Freq Diff (MHz)
0.153	-200.105	0.105
1.759	-199.999	-0.001
2.623	-199.999	-0.001
4.896	-199.998	-0.002
8.822	-199.996	-0.004
11.629	-199.995	-0.005
13.774	-199.994	-0.006
15.365	-199.993	-0.007
18.181	-199.992	-0.008
20.743	-199.991	-0.009
22.961	-199.990	-0.010
25.783	-199.989	-0.012

Fig. O2 — Sample data sheet

Appendix P

CABLE CALIBRATION CHECK

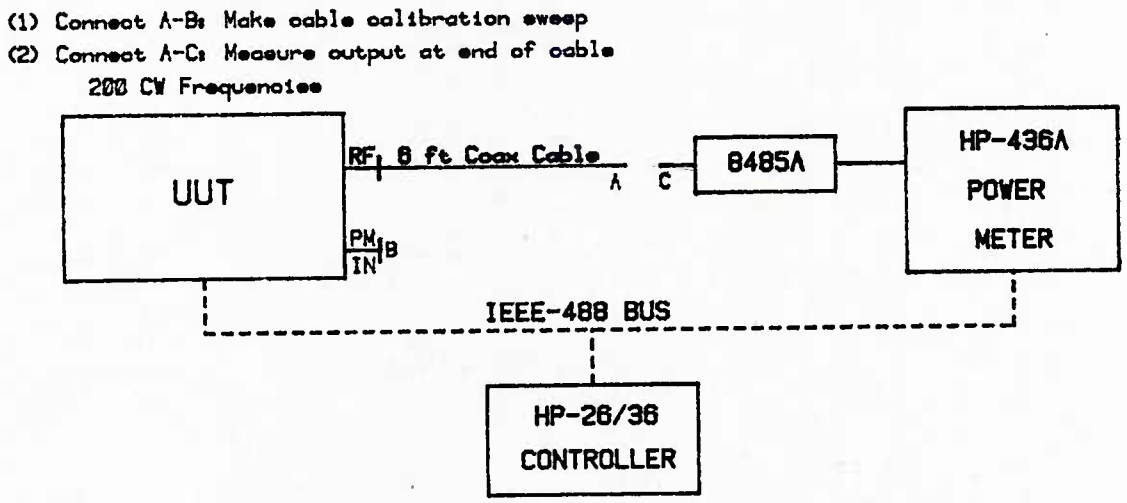


Fig. P1 — Cable calibration function test

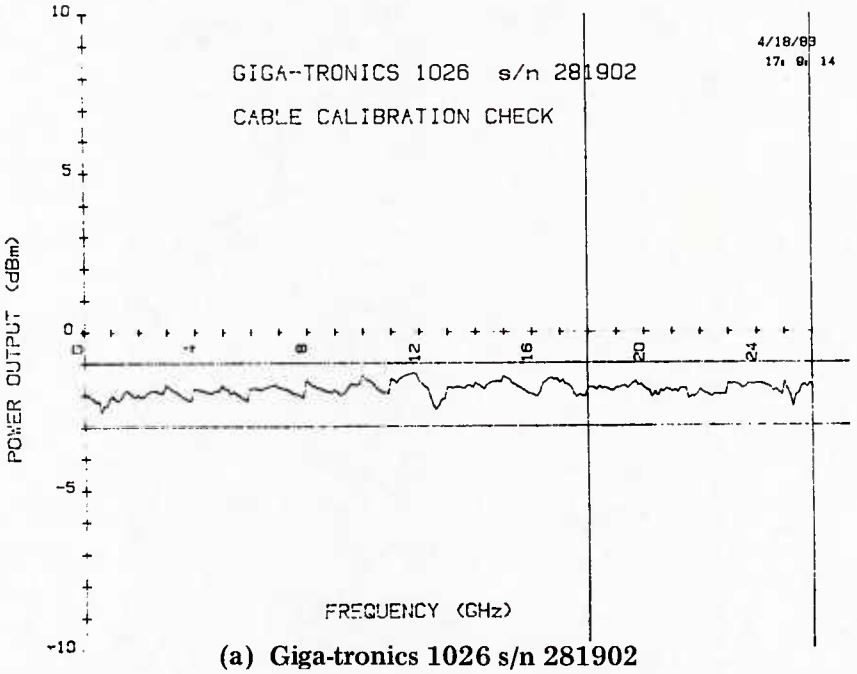
CABLE CALIBRATION FUNCTION TEST

Language: HPL Controller: HP-26/36

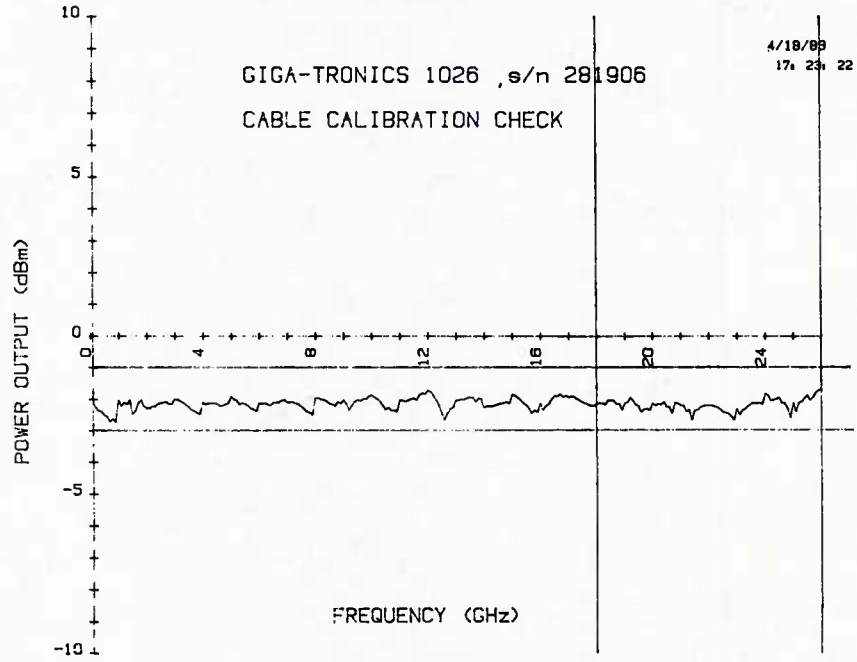
```
 0: "CABLE CALIBRATION CHECK GT 1026 - [cableCAL]";
 1: "Connect PM to end of Calibrated Cable; 436A (watts)":
 2: sfk 0;sfk 1;sfk 2;sfk 3;sfk 4;sfk 7;sfk 8;sfk 9
 3: sfk 4,"*cont 53","[P] plot"
 4: sfk 9,"*edit148","[P]Labels";aclr ;gclr
 5:
 6: dim A[0:600],F[0:600],X$[80],S$[25],V[3],A$[8,2],C$[10],Y[30
 ],N$[15]
 7: dim T$[8],D$[10]
 8: lcl 725;aclr
 9: wrt 16,"CONNECT Cable:  RF Out -} 1026 PM Input";wrt 16;beep
 ;stp
10: wrt 16,"Activate EXT and delP pushbuttons";wrt 16;beep;stp
11: wrt 16,"Activate SINGLE SWEEP for Cable Cal";wrt 16;beep;st
 p
12: wrt 16,"Release EXT and delP pushbuttons";wrt 16;beep;stp
13: wrt 16,"CONNECT 436 PM -} Cable Output";wrt 16;beep;stp
14: ent "Initialize?  [C]=No 1=Yes",H;if flg13;0}H;gsb "INIT"
15: if H=1;aclr ;list 144,149
16: if H=1;stp
17: ent "SET Clock?  [C]=No 1=Yes",Q;if flg13;0}Q
18: if Q=1;cll 'CLOCK'
19: ent "Test Output Power Level?",W;0}L
20: ent "8485 S/N? [C]=648 1=163 2=180",S;if flg13;0}S;gsb "648
 "
21: if S=1;gsb "163"
22: if S=2;gsb "180"
23: ent "START Freq? (GHz)  [C]=.1",V[1];if flg13;.1}V[1]
24: ent "STOP Freq? (GHz)  [C]=26.5",V[2];if flg13;26.5}V[2]
25: ent "# Freq STEPS?  [C]=264",V[3];if flg13;264}V[3]
26: V[2]-V[1]}r10;-.15r10+V[1]}r1;V[2]+.05r10}r2
27: if I=0;gsb "CRT"
28:
29: for I=0 to V[3]
30: fxd 2;0}T
31: "FREQ EQUATION":V[1]+(V[2]-V[1])*I/V[3]}F
32: gsb "G/T"
33: 1e9*F}F[I]
34: gsb "436A"
35: cll 'CF'(F,Y)
36: T/3+.047(100-Y)+Z}A[I]
37: plt F,A[I]
38: "STATUS":gsb "Stat-GT"
39: fmt 7,f5.2," dBm ",f8.3,f5.0,2f3.0;wrt .7,A,F,I,U,V
40: if I>1;fmt 6,f8.3,f7.2,f9.2,f7.2;wrt 16.6,F,A[I],A[I]-A[I-1
 ],.047(100-Y)
41: next I
42: beep;ent "[C]=Hardcopy 1=Soft",C;if flg13;psc 705;gto 52
43: gto "PLOT"
44:
```

```
45: "436A":for J=1 to 3
46: wrt 713,"A+V";fmt :red 713,A;red 713,A
47: if A<0;1e-6}A
48: 10log(A/1e-3)}A;A+T}T
49: next J;ret
50: "PLOT":psc 16;gclr:csiz 1.5
51: scl r1,r2,r3,r4;fxd 0;xax r6,r7,int(r5),V[2],4;yax r5,r8,r3
,r4,r9
52: gsb "Pen"
53: for K=0 to V[3]
54: plt F[K]/1e9,A[K]
55: next K;pen
56: "Y-Axis Mks":ent "Y-value  [C]=Quit",B;if flg13;jmp 2
57: plt r5,B,-2;plt r2,B,-3;jmp -1
58: "X-Axis Mks":ent "X-value  [C]=Quit",B;if flg13;jmp 2
59: plt B,r3,-2;plt B,r4,-3;jmp -1
60: scl 0,10,0,10
61: csiz 2,1.5,8/11,0;plt 4,.5,3;lbl "FREQUENCY (GHz)"
62: csiz 2.2,1.5,8/11,0;plt 3,9,3
63: lbl "GIGA-TRONICS 1026  ",N$
64: plt 3,8.3,3;lbl "CABLE CALIBRATION CHECK "
65: plt 9,9.5,3;csiz 1.3;lbl D$
66: cll 'Read Time'
67: csiz 2,1.5,8/11,90;plt .5,3,3;lbl "POWER OUTPUT (dBm)"
68: psc 16;ent "[C]=HDCPY 1=PRT",C;if flg13;0}C;psc 705;gsb "Pe
n"
69: csiz 1.5;gto 51
70: "Write":sfg 1;scl 0,10,0,10;gsb "DISP"
71: psc 16;if C=1;psc 705;scl 0,10,0,10
72: ent "X",U;ent "Y",V;plt U,V,3;ent "[C]=Repos 1=PRT",P;if fl
g13;jmp 0
73: ent "Format? (1-8)",F,"Angle? 0=Hor 90=Vert",A
74: csiz F,1.5,8/11,A;ent "Label 80<Spaces",X$;plt U,V,3;lbl X$
75: ent "[C]=CHG 1=Repeat 2=Cont 3=Quit",R;if flg13;0}R;gto "DI
SP"
76: if R=1;plt U,V,3;lbl X$;plt 10,10,3;gto "DISP"
77: if R=2;lbl X$;jmp -2
78: if R=3;stp
79: "DISP":gclr;aclr ;psc 16;scl 0,10,0,10
80: plt .5,8;csiz 1;fxd 2;lbl "X =",X,"      Y =",Y
81: plt .5,7.5;csiz 2;lbl "U =",U,"     V =",V
82: plt .5,4;csiz 2;lbl "L Size =",F,"   Angle =",A
83: plt .5,3.5;csiz 1;lbl "X$ Label:";plt 1.7,3.5
84: lbl X$
85: if flg1;cfg 1;ret
86: gto 71
87: "648":
88: data 100,99.7,98.8,99,98.6,97.9,97.8,97.6,97.4,97.1,97.1,97
.2,96.2,96
89: data 95.8,95.3,95,94.8,92.9,91.7,92.5,93.8,92.8,93.1,92.2,9
1.6
90: for J=2 to 27;read Y[J];next J
91: ret
92: "163":
93: data 100.1,99.2,99,99.3,98.8,98.4,97.9,97.8,97.6,97.5,97.1,
97.4,96.7
94: data 96.1,95.2,95.5,95,95.1,93.7,92.8,92.9,92.6,91.3,91.8,8
8.3,85.2
95: for J=2 to 27;read Y[J];next J
96: ret
```

```
97: "G/T":if I=0 and L=0;wrt M,"GENFIXED MODOFF LEVEL",W
98: if I=0 and L=1;wrt M,"GENFIXED MODOFF LEVEL15"
99: fmt 2,"FA",f5.0
100: wrt M+.2,1000F
101: wait 200;ret
102:
103: "CRT":psc 16;gclr;aclr ;fxd 0
104: V[1]}r5;0}r6;1}r7;1}r8;5}r9
105: if r10<=10;.5}r7;fxd 1
106: if r10<=5;.2}r7;fxd 1
107: if r10<=2;.1}r7;fxd 1
108: ent "Output RANGE? (dBm) Top  [C]=+10",r4;if flg13;10}r4
109: ent "Output RANGE? (dBm) Bottom  [C]=-5",r3;if flg13;-5}r3
110: r4-r3}r11;fxd 0
111: if r11<=10;2}r9;fxd 1
112: if r11<=5;1}r9;fxd 1
113: if r11<=2;2}r9;.25}r8;fxd 2
114: if r3>0 or r4<0;ent "Y-intercept",r6
115: csiz 1.5;scl r1,r2,r3,r4;xax r6,r7,V[1],V[2],4;yax r5,r8,r
3,r4,5
116: ret
117:
118: "Stat-GT":wrt M,"SENDSTATUS";red M,S$
119: val(S$[7,8])}U;val(S$[15,16])}V
120: fmt 8,"UNlevel at",f6.1
121: fmt 9,"UNlock at",f7.1
122: if U=0;wrt 16.9,F
123: if V=0;wrt 16.8,F
124: ret
125:
126: "CF":if p1<=2;100}p2;ret
127: for J=2 to 26
128: if p1>=J;J}p3;Y[J]}p4;Y[J+1]}p5
129: next J
130: p4+(p1-p3)(p5-p4)}p2
131: ret
132:
133: "INIT":
134: "--- UUT Address":725}M
135: "--- UUT s/n":"s/n 281902"}N$
136: "--- Date":"4/18/83"}D$
137: wrt 16,D$,"     UUT is ",N$
138: ret
139:
140: "CLOCK":
141: "Set Time":
142: ent "Time? (hhmm.ss)",p1
143: int(p1/100)}p2;int(p1-100p2)}p3;100frc(p1)}p4
144: stime p4+p3*60+p2*60^2
145: ret
146:
147: "Read Time":
148: rtime}p1
149: int(p1/3600)}p2;p1-p2*60^2}p3
150: int(p3/60)}p4;p3-60*p4}p5
151: fxd 0;plt 9,9.2,3;csiz 1.2;lbl p2,":",p4,":",p5
152: ret
153:
154: "Pen":
155: ent "Pen # CHANGE?  0=NoPEN (1-4)  [C]=#1",P;if flg13;1}P
156: pen# P;ret
```



(a) Giga-tronics 1026 s/n 281902



(b) Giga-tronics 1026 s/n 281906

Fig. P2 — Sample data sheet; cable calibration check